

Casting for Carbon Fibre Orthotics

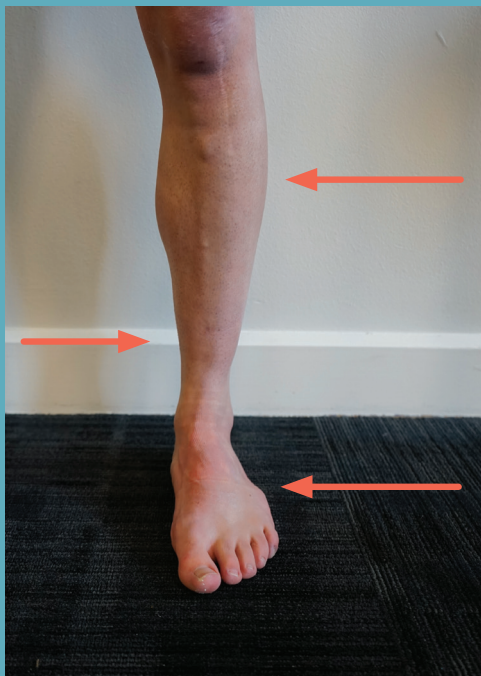


Introduction

It is important to take time and consider the properties of carbon fibre when casting for AFOs and KAFOs. Detailed design and patient information are required by the manufacturing unit.

It can be helpful to plan the device based on the forces you wish to apply to the limb as additional design options are available when using prepreg carbon fibre compared to plastic devices.

**3 point force correction
– frontal plane**



**3 point force correction
– sagittal plane**



Required Information

Weight

It is important that we have an accurate weight for the person so that the lay ups can be made appropriate for the design of the device.

Activity Level

Is the device going to be used to walk around the house or do they plan on running? It can be helpful to categorise the activity level as Low, medium or High using your best judgment if in doubt use the next category up.

It is important to establish the person's perception of activity level. What one person considers low level activity may equate to another's high level activity.

It is useful to know if they regularly walk on uneven terrain for example when walking dogs, as this may influence the design.

Shoe Pitch

Due to carbon fibre's rigid nature the pitch of the shoe is particularly important and providing a sample shoe for manufacture will allow for an improved fit and alignment of the final Orthosis.

If possible cast using a casting board set to the correct pitch and alignment.

Photographs

If possible photographs of the leg are helpful for production. Trim lines can be drawn on to the photographs as seen below. Highlighting fit and design features.

Fastening Options

Traditional Velcro strap systems can be used or alternative fastenings such as the BOA™ system may be built into the design.

Test Orthosis

Running only. High activity not for walking

Specify fastening configuration:
ex: hook & loop, BOA™, buckles, etc

Clarify forefoot stiffness and desired toe roll

Specify desired stiffness of posterior strut on a gradient scale of 1-5 *

Define trim lines

*Gradient Scale

Grade 1

flexibility for a more flaccid footdrop

1

2

3

4

5

Grade 5 for increased tone and impairment in multiple leg muscle groups

A test Orthosis is made of clear thermoplastic which will allow you to assess the fit and see areas of pressure. The draped test orthosis can be made with accommodation for the interface lining if requested in the specification.

The test Orthosis will come with extended trims however requested trim lines will be marked onto the clear thermoplastic and these can be adapted with permanent however alterations required can be marked onto the clear thermoplastic in permanent marker pen to allow for adaption prior to completion.

Clear thermoplastic is heat mouldable and therefore at trial fit the Orthosis can be adapted, it is important to highlight to the technician where the heated adaption have been made.

The test Orthosis will be larger and thicker than the definitive device. It will also be more flexible than the finished device therefore consider the fitting issues if you need to flex the test orthosis in order to don/doff the device. The definitive device will not be flexible to don/doff.

The clear thermoplastic test device will allow areas of high pressure to be visible so they can be marked and allowance added if requested.

The test device is not suitable for home trial and should only be used in a clinical environment.



Helpful Tips

- It can be helpful to number points of interest on the test device for use on the fitting note.
- It is best to mark the test orthosis with a permanent pen that will not rub off during transport.
- If the test orthosis is loose tighten the straps as required and mark the position of the trim lines on to the straps, as seen overleaf.

Important Fitting details to consider:

Once the device is pulled in will the patient still be able to don/doff the brace given the limited flexibility of the carbon fibre. Can the trim lines be adapted for ease of don/doffing.

When weight bearing in the test orthosis the clear thermoplastic may flex away from the foot, this can be difficult to spot when trialling the Orthosis in a shoe and if not considered at fitting may result in the definitive orthosis being too tight around the foot and ankle or midfoot area.

The test Orthosis will not be as rigid as the definitive product and this should be taken into account when assessing the fit and comfort of the patient.

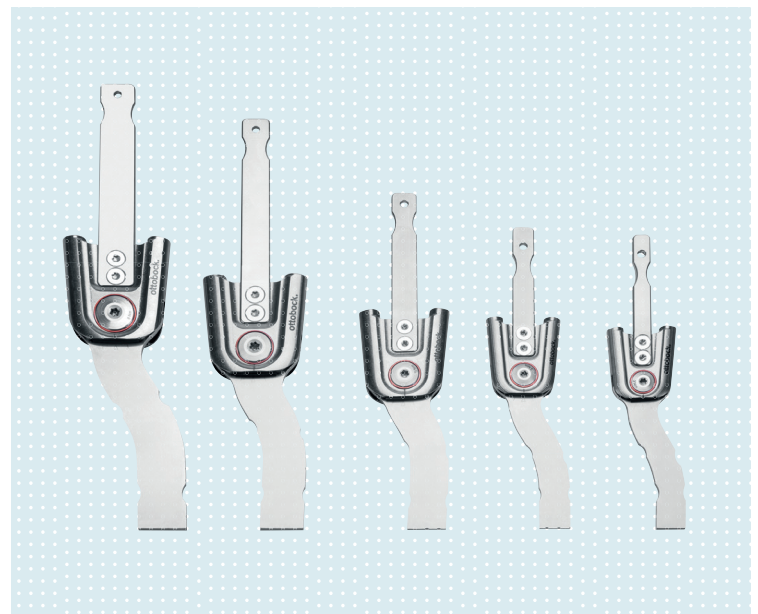


Unilateral Joint Systems

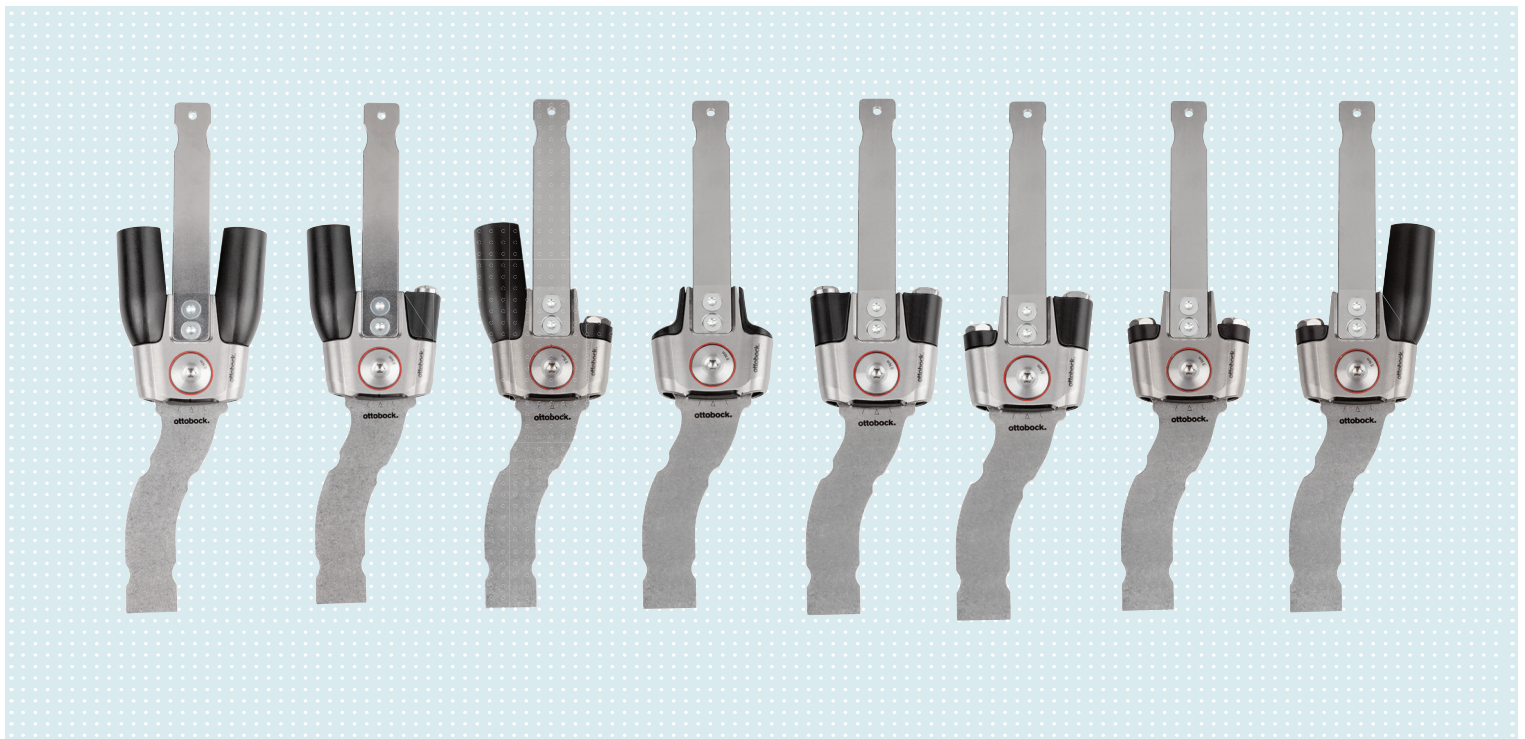
When using a unilateral joint system it is important to consider the Frontal plane alignment especially at the knee.

If there is any un corrected valgus in the device the lever arms applied to the joints and attachment point may lead to increased wear and tear plus an increased potential for failure especially on uneven terrain or adverse camber.

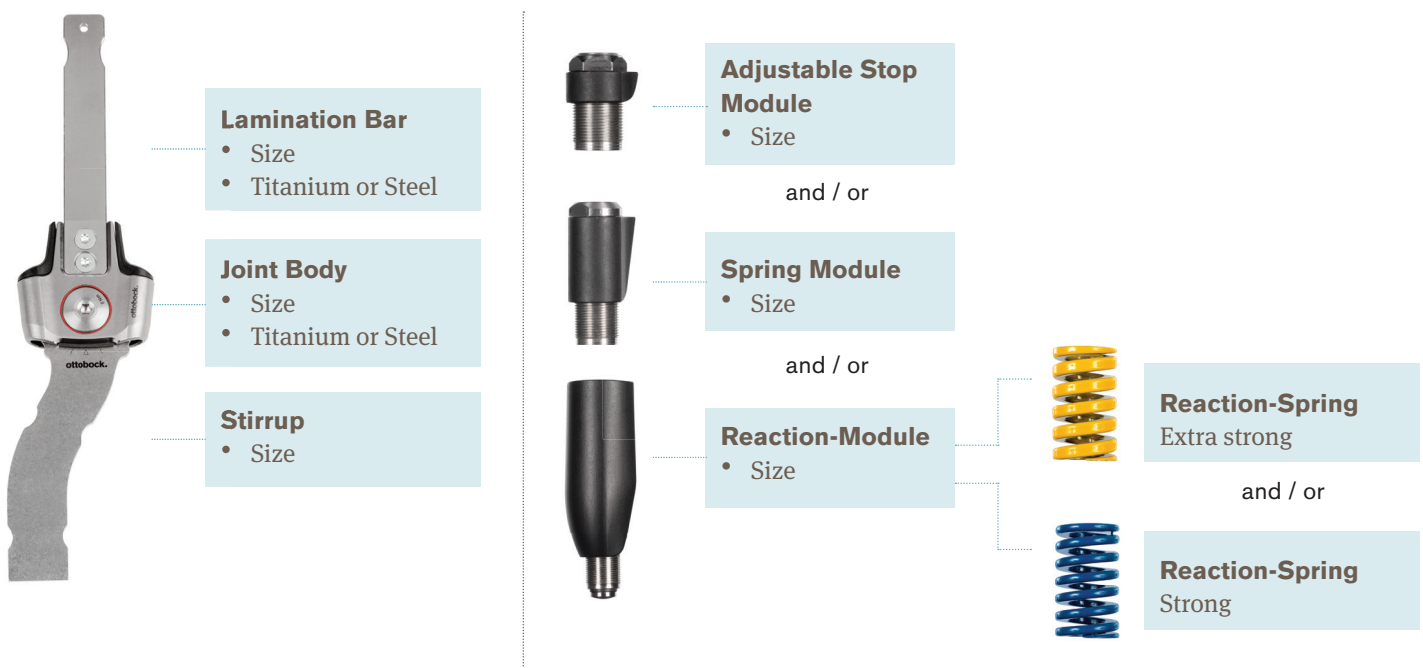
With unilateral ankle joints it is important to consider what blocks to movement are required. For example, if a rod is used in the anterior chamber of the 17LA3N and Nexgear Tango, which is then set in plantarflexion to achieve a knee extension moment, then large forces will be applied to the attachment bars. If this is the expected set up, then in order to achieve longevity of the device bilateral joints may be required.



NexGen Tango



Selection and ordering



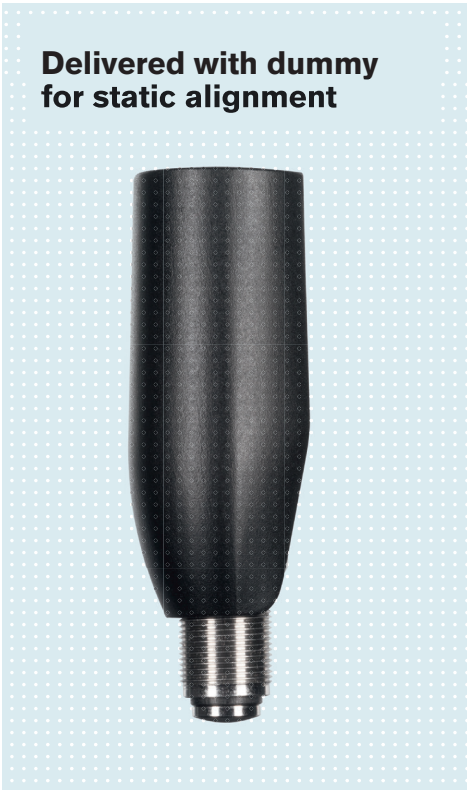
NexGen Tango

Reaction-module

Article number	Unilateral use (max body weight)	Bilateral use (max body weight)
17AD100A=HS-10	15 kg	25 kg
17AD100A=HS-12	20 kg	40 kg
17AD100A=HS-14	50 kg	80 kg
17AD100A=HS-16	85 kg	120 kg
17AD100A=HS-20	110 kg	160 kg

Weight of Reaction-Module:

Size 10	Size 12	Size 14	Size 16	Size 20
34g	38g	63g	110g	110g



Carbon Fibre Pointers

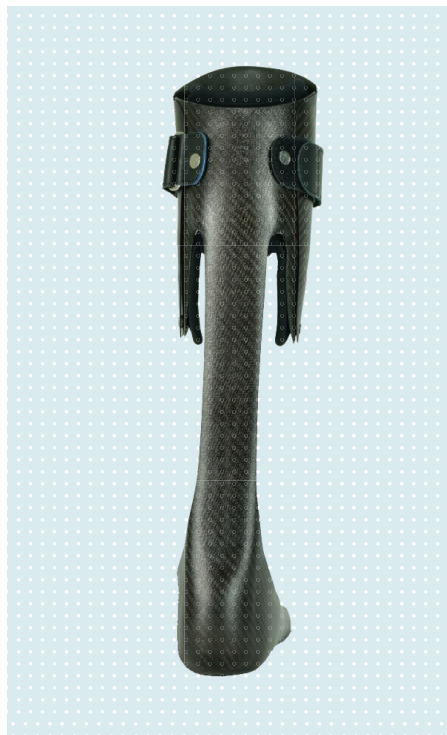
Carbon fibre is brittle and Carbon fibre composites have no yielding behaviour however the tolerance is improved with the addition of materials such as Kevlar and Dyneema.

Carbon fibre has a high stiffness therefore high stresses are developed when bending/flexing. To minimise the risk of breakage the bend radius should be as large as possible.

- For example when using PLS design the longer the posterior bar, the larger the radius will be once flexed.



Carbon Composite Bars



As a general rule Carbon composite bars (like in a PLS) should be made as straight and flat as possible. This will ensure that the bar bends in the desired plane.

It is possible to state where you would like the footplate to flex or if you would like the footplate to be rigid.

Helpful Tips

- If a rigid footplate is required the pitch of the shoe would be required and it can be helpful to have a sample shoe.
- A rigid footplate will provide a large knee extension moment at terminal stance which while desirable in some patient groups if a locked knee the force will be transmitted to the knee joint potentially increasing wear on the joint and steels.
- A rigid footplate will provide a strong resistance to forward progression by blocking the 3rd rocker.

Custom AFO Order Form

Client details

Date of Cast		Sex	Male ☐	Female ☐
Name		DOB		
Diagnosis		Clinic		
Orthotist		Order No.		

Negative cast details

As cast ☐ 90° ☐ Calcaneus square ☐ Squared sides ☐ Dorsiflexed ☐ degree value _____ Plantarflexed ☐ degree value _____

Positive cast rectifications

Behind M.T.H. ☐ On M.T.H. ☐ Sulcus ☐ Full foot ☐ Neuro footplate ☐ 3 Point pressure ☐ Roll top ☐

AFO style

RT ☐ LT ☐ Bilateral ☐ AFO ☐ GRO ☐ DAFO ☐ Clam shell ☐ GRO (oxford front) ☐ SAFO ☐

Material requirements (please state two transfer choices, if no transfer or colour stated natural will be used)

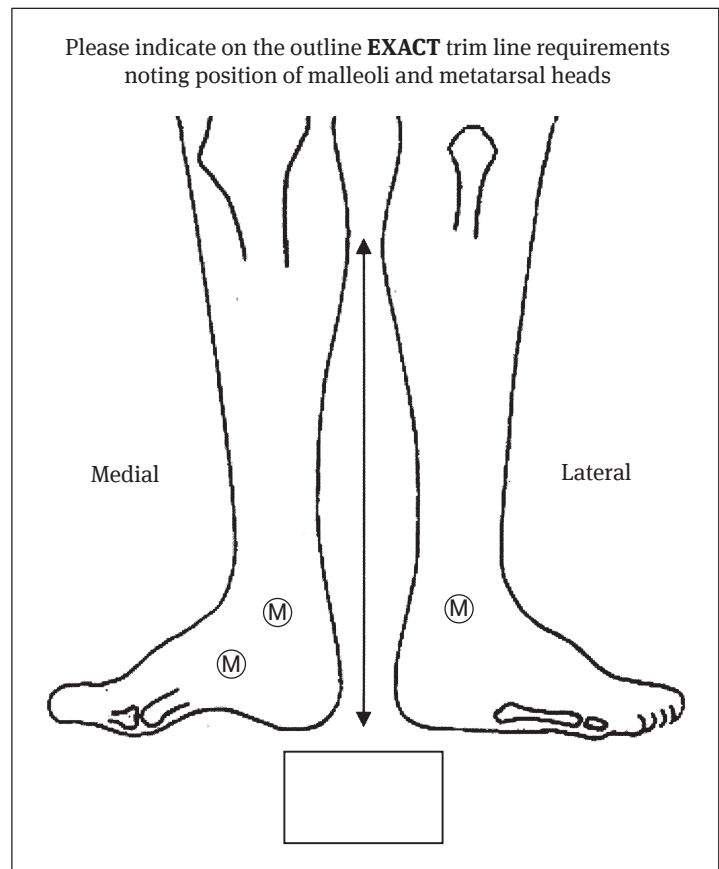
Natural polypropylene _____
 Carbon fibre _____
 Homopolymer polypropylene _____
 Ortholen _____
 Sub Ortholen _____
 Polyethylene _____
 Colour _____
 Transfer Choice 1 _____ 2 _____

Material thickness (mm)

2 ☐ 3.1 ☐ 4.7 ☐ 5 ☐ 6 ☐
 Carbon reinforcement req Yes ☐ No ☐
 Ribbed reinforcement req Yes ☐ No ☐
 Hinged ☐ Plastic ☐ Metal ☐

Strapping requirements (unless stated all straps will be velcro, leather backed with D ring. Calf and heel straps will be fitted as standard)

Sliding pads	☐	Strap colour	
Navicular	☐	Black	☐
Lay on velcro	☐	Blue	☐
Y strap	☐	Flesh	☐
Forefoot	☐	Natural	☐
Fairfield	I/S ☐ O/S ☐	Red	☐
Other	_____		



Lining padding requirements

Line calf _____
 Full lining _____
 Padding over Malleoli _____

Addition measurements

Met width LT _____ RT _____
 Mall width LT _____ RT _____
 Mall height I/S _____ O/S _____
 Footplate length in mm _____

Additional requirements

If using carbon fibre please select posterior strut rigidity graded 1-5: _____

KAFO Cosmetic Specification Form

PATIENT NAME

Hospital / Clinic Order no
 Age Sex Weight Height
 Infant ☐ Child ☐ Medium ☐ Adult ☐ Ex Large ☐
 Activity level High ☐ Medium ☐ Low ☐
 Non correctable deformities (knee) i.e. knee will not fully extend:
 Valgus Varus
 Flexion
 Special considerations

NEGATIVE CAST DETAILS

Make as cast Knee ☐ Ankle ☐
 Correct knee to Correct ankle to

POSITIVE CAST RECTIFICATION

Sust Tali ☐ Dorsiflex Toes ☐ 3 Point Pressure (shade areas) ☐
 Other ☐
 Build ups (3mm default build up)
 Lat Mal mm Med Mal mm
 Navicular mm Other mm
 A.K. Section Quadrilateral Shaping ☐
 Flare Top Back Edge ☐ Ischial Bearing ☐

REDUCE CIRCS DOWN TO

RT LT

N.B. see measurement chart for exact levels of these circs with reference to knee joint positions
 Top mm mm
 Middle mm mm
 Bottom mm mm
 Allowance for linings 3mm ☐ 6mm ☐

STYLE

Moulded over side stems ☐ Side stems fitted on to outside ☐
 Articulated AFO section ☐
 Specify type of hinge (manufacturer / part no)

TRIM

A.K. scoop out bottom back edge
 Centre opening width (default – 25mm)
 Other details – see sketches for exact trim

MATERIALS

	AK	BK	AK	BK
Natural Polypropylene	☐	☐	Thickness 3mm ☐	☐
Flesh Polypropylene	☐	☐	4mm ☐	☐
Coloured Polypropylene (specify)				
Homopolymer	☐	☐	4.5mm ☐	☐
Ortholen	☐	☐	5mm ☐	☐
Leather	☐	☐	6mm ☐	☐
Transfers (specify)				

JOINTS

Bale lock ☐	Ring lock ☐	Free set back ☐
Dural ☐	Steel ☐	Titanium ☐
16mm ☐	20mm ☐	

Manufacturers ref / part no

LININGS

Allowance for linings	3mm ☐	6mm ☐	
	A.K. (full)	B.K. (full)	B.K. (part)
Northfoam 3mm	☐	☐	☐
Northfoam 5mm	☐	☐	☐
Plastazote 3mm	☐	☐	☐
Plastazote 6mm	☐	☐	☐
Leather	☐	☐	☐
Other (specify)	☐	☐	☐

Shade areas on diagram that require lining

KNEE CONTROL

Anterior ☐ Medial ☐ Lateral ☐ Posterior ☐
 Compression ☐ Valgus ☐ Varus ☐ Hyperextension ☐

STRAPS

Velcro (all leather backed) ☐ Bridal Leather ☐
 A.K. (no.) B.K. Calf (no.)
 Instep Strap Backed Velcro ☐ Unbacked Velcro ☐
 20mm ☐ 32mm ☐
 Other (specify)

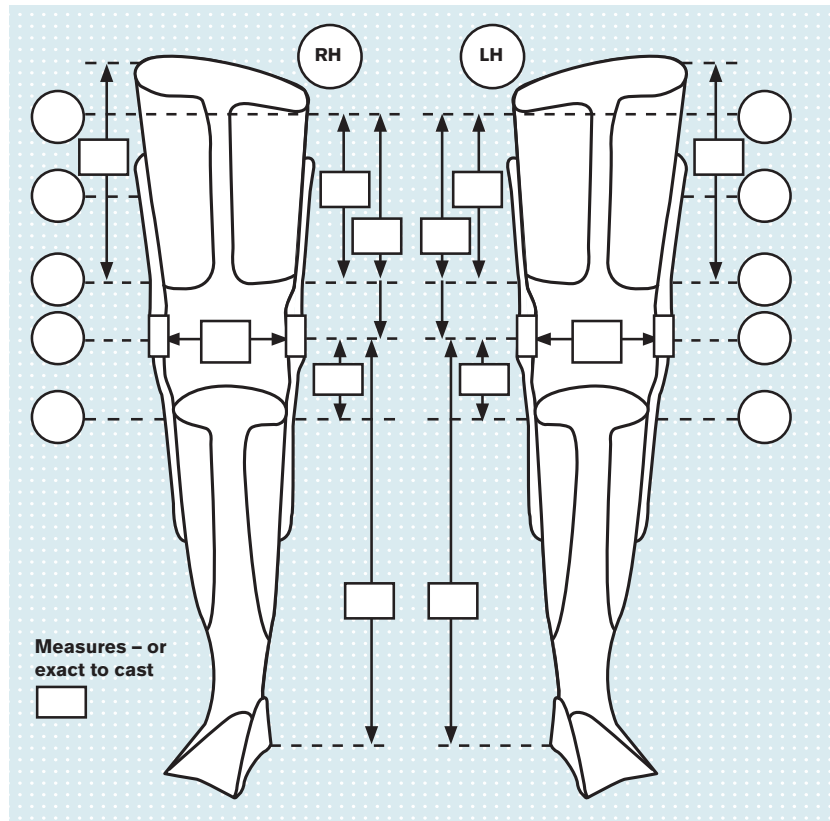
LAPELS

Leather ☐ Pelite ☐ Other ☐
 Knee Back Sling (for hyperextension) ☐
 Other details

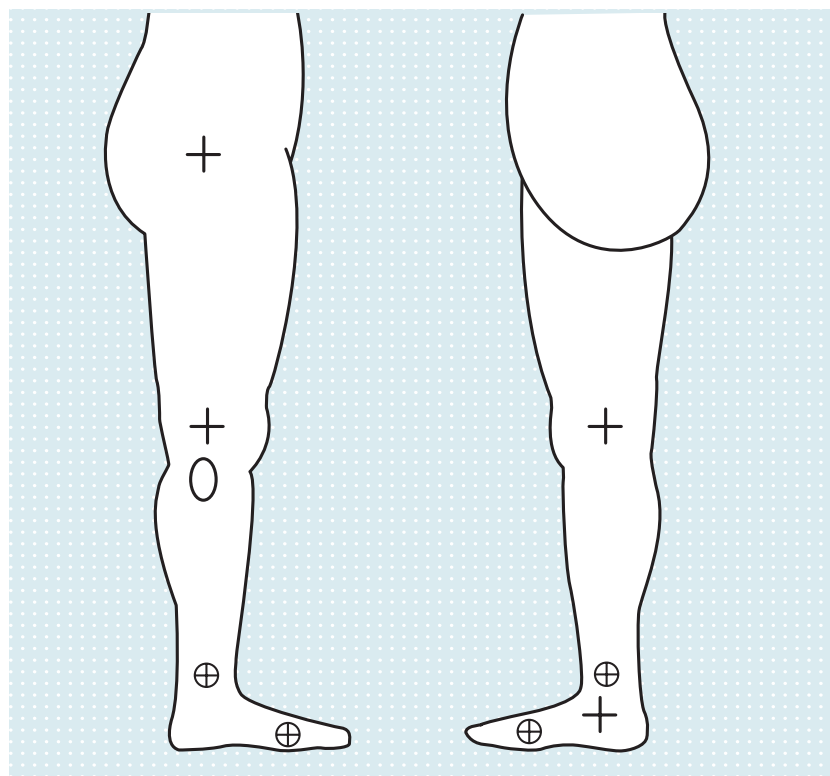
Please note:

As a minimum the following areas must be marked onto the negative plaster cast in indelible pencil: a) top line of A.K. section: b) bottom line of A.K. section: c) knee joint axis: d) top line of B.K. section: e) med & lat malleoli: f) 1st and 5th met heads. No liability will be accepted for ill fitting KAFO's where essential information has not been supplied.

KAFO Cosmetic Specification Form



Additional comments / specifications



Additional comments / specifications

Otto Bock Healthcare PLC

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Carbon Fibre KAFO / E-MAG Order Form

PATIENT NAME

Hospital / Clinic
Orthotist
Patient weight
Age
Order number
Date

Shoe sent

Yes ☐ No ☐

Negative cast AK

As cast ☐

Correct knee

To

Negative cast BK

As cast ☐

Correct ankle

To

Positive cast AK

Ischial bearing ☐

Flared top edge ☐

Clam shell ☐

Positive cast BK

Full foot ☐

¾ foot ☐

GRAFO ☐

Clam shell ☐

Flared top edge ☐

LAPELS

Leather ☐ Pelite ☐ Other ☐

Knee Back Sling (for hyperextension) ☐

Other details

Foot correction

Medial posting

Lateral posting

Left ☐

Right ☐

Type of Orthosis

E-MAG ☐

Cosmetic CF KAFO ☐

Knee joints

E-Mag Medial Joint ☐

E-MAG 5° ☐ 7.5° ☐

Free joint

Bale lock

Ring lock

Drop lock

Unilateral

Ankle joints

Dual Action spring joints

Free joints

No ankle joints ☐

Unilateral

Other types

Linings

Full ☐ AK ☐ BK ☐

Spacetex ☐

Blue terry ☐

Plastazote ☐

Leather ☐

Velcro straps

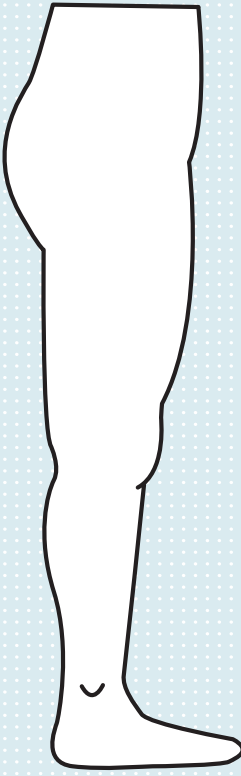
AK No ☐ Pad ☐

BK No ☐ Pad ☐

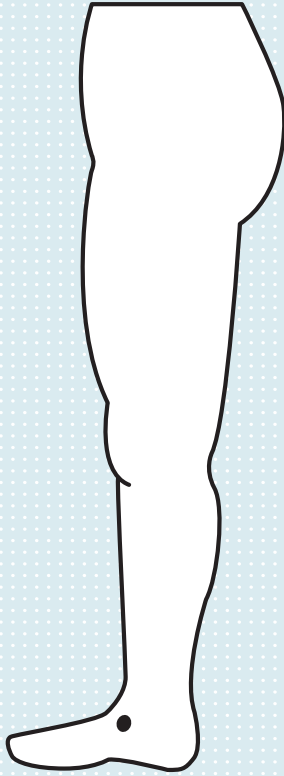
Ankle ☐

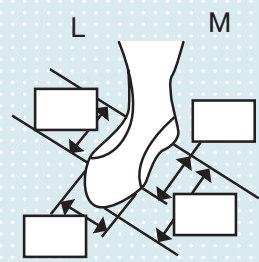
Carbon Fibre KAFO / E-MAG Order Form

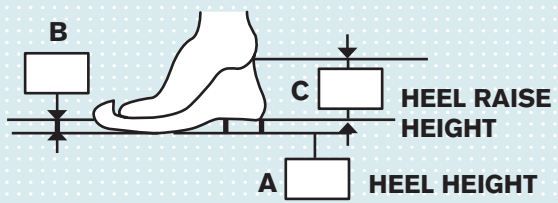
LATERAL



MEDIAL



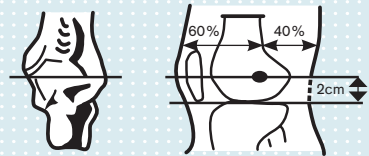




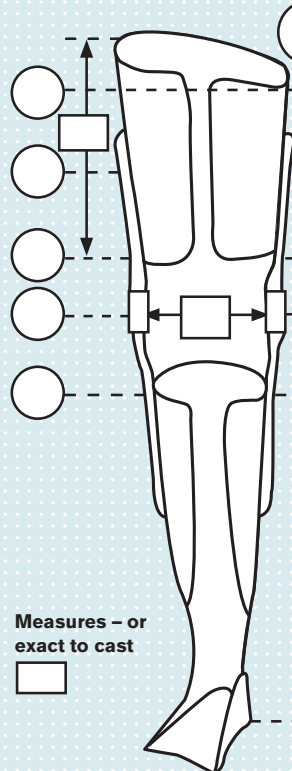
HEEL RAISE HEIGHT

HEEL HEIGHT

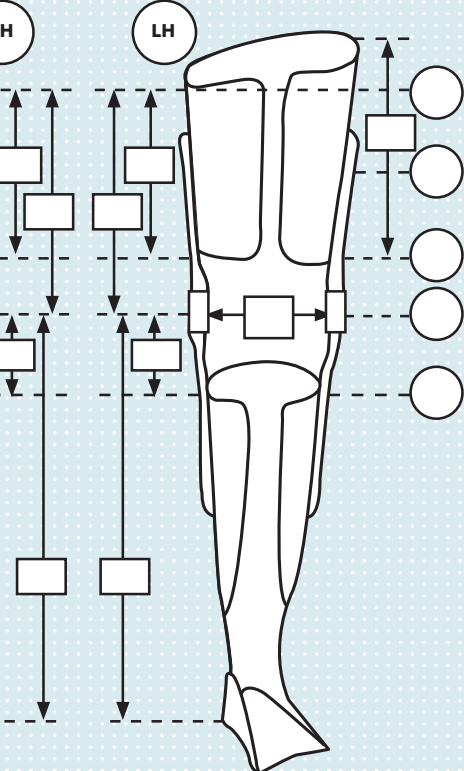
A - B = EFFECTIVE HEEL HEIGHT



RH



LH



Measures – or exact to cast



Additional comments / specifications

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Otto Bock Healthcare PLC

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