COMFIL®

THERMO FORMABLE COMPOSITE TECHNIQUE

from Fillauer LLC and Centri®

FABRICATION MANUAL

Fillauer COMPANIES

COMFIL® THERMO FORMABLE COMPOSITE TECHNIQUE

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Composite or Plastic? Get the best of both worlds with Fillauer's new versatile Comfil® Thermo Formable Carbon composite material.

The Thermo Formable material combines the high localized strength of carbon composite with the modeling properties of thermoplastics. Available in unidirectional and bidirectional, the carbon fibers are interwoven with a revolutionary thermoplastic fiber that allows the material to be heated and formed at lower temperatures. This thermoplastic material also acts as a high-strength matrix for active performance and flexibility. The material can be simply custom formed to your mold with a heat gun or by placing the material into an oven to achieve molding and extra reinforcement materials can be simply heated and applied to customize your brace for the patient's needs. Your custom lay-up is then placed into a standard oven under vacuum at a maximum of 430° F for 30-45 minutes to consolidate the lay-up into one piece for an individual orthotics or prosthetic solution. The material is also fully heat remoldable, and allows adjustable fitting just like thermoplastics and unlike prepegs. The material comes in unidirectional and bidirectional reinforcement for different structural properties with three different thicknesses and can be cut simply with scissors. Equipment such as vacuum lines, vacuum chamber, water reduction, stands, and oven adaptations are also available.

Choose our Thermo Formable Carbon material to make your next custom composite solution!

Contents

Fabrication Instructions for AFO and KAFO

1. CAST PREPARATION

Fig. 1

Fig. 2

a) Make appropriate modifications to model and smooth with plaster slurry to fill any blemishes.

b) Thoroughly dry mold for approximately 12 hours to reduce moisture in model. Moisture in model will lower material heat and increase consolidation time in oven.

c) Smooth all sharp edges of model and coat with cast sealer to aid in smoothing (Recommended Sealer: PN-199509, CELLULOSE CRYSTALS).

d) Establish trim and layout lines on model to determine placement of precut or custom lay-out materials (Fig. 2).

2. LAY-UP

Fig. 3

Fig. 4

Fig. 5

Fig. 6

a) Apply cotton or PET high temp stockinette breather/ wick to model (Fig. 3), this will allow the material to adhere to model throughout the lay-up process. Note: Multiple layer sandwich construction is recommended for maximizing strength and durability.

b) Apply each layer to model by heating and forming the material through use of a high temp heat gun or by pre-heating material in an oven with a recommended temp of 350º for around one to two minutes (Fig. 4).

c) Smooth all edges of the material during application process

d) Apply each layer of the lay-up material in a sandwich-like construction creating an I-Beam effect until all layers are applied (Fig. 5).

e) Check all layers for flat surfaces and smooth edges.

Note: Use 'Angled Scissor Shears' (PN-600350) to cut. and trim TFC material (Fig. 6).

3. TRIM LINES / GRINDING

Fig. 7

Fig. 8

Fig. 9

a) After lay-up is complete, remove brace from model (Fig. 7).

b) Remove breather/wick from inside of brace to prepare for grinding of trim lines (Fig. 8).

c) Grind brace to remove unwanted material (Recommended Grinding Tool: Trautman Carbide Cutting Tool #225252) (Fig. 9). Note: Friction from grinding tools may generate high heat that will melt the material and cause gumming.

d) Use most aggressive cutter at beginning of grinding process to minimize heat buildup.

e) Remove excess material during grinding process while moving around brace. Note: Grinding in one area excessively can generate excess heat and cause gumming.

4. PREPARATION AND CONSOLIDATION
4a. Release Film

Fig. 10

Fig. 11

Fig. 12

a) Consolidation process can begin after trim lines are established and brace is smooth.

b) Apply a coat of spray adhesive (PN-199451) to model (Fig. 10).

c) Apply a layer of red release thin film (PN-600335) by stretching film over model (Fig. 11) and rubbing film with hand until smooth (Fig. 12). Note: It is not necessary for film to be completely free of all wrinkles.

d) Once smooth, pull film down and secure to pipe/ stand with high-temp Teflon tape (PN-600315).

4b. Breather / Wick

Fig. 13

Fig. 14

Fig. 15

Fig. 16

a) Apply two layers of L-Pet (PN-700070021/10mm) over the release film covered model (Fig. 13).

b) Apply brace back to model (Fig. 14).

c) Apply two additional layers of L-Pet material (PN-700070021/10mm) over brace to provide high-gloss finish after consolidation (Fig. 15).

d) Cut and remove any excess L-Pet material (Fig. 16).

4c. Silicone Sheeting

Fig. 17

Fig. 18

Fig. 19

Fig. 20

a) Application of silicone sheeting (PN-600320) is used as a buffer from the high-temp vacuum bag and adds a high-gloss finish to brace. Note: Silicone sheeting can be re-used.

b) Apply silicone sheeting to model by securing to toe section with Teflon tape (PN-600315) without attaching tape to TFC material (Fig. 17 and 18).

c) Stretch silicone sheeting to cover the brace material and pull out any wrinkles so silicone lies flat over material (Fig. 19).

d) Secure sheeting to model. Make sure material lies flat, wrinkle-free, without Teflon tape applied over material
(Fig. 20). Note: Teflon tape is an insulator and can leave a discolored look if tape is placed over or on top of the material.

4d. High Temp Vacuum Bag

Fig. 21

Fig. 22

Fig. 23

a) Apply a breather/wick to model after silicone sheeting is applied to create a vacuum around the brace (Fig 21).

b) Attach the brace to the vacuum stand (pn-700000006) and tape the rest of the excess wick/breather material to secure the vacuum (Fig. 22 and 23).

Fig. 24

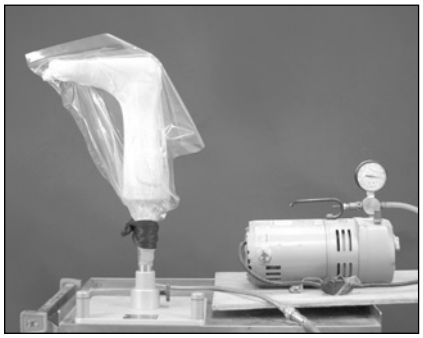


Fig. 25

c) Select and apply an outer high-temp vacuum bag (PN-600331/pack of 12).

d) Place the high-temp vacuum bag over the brace. Secure and seal the bag with one to two layers of double-sided seal tape (PN-600311) (Fig. 23, 24) to the pipe/stand. An additional layer of high-temp Teflon tape over the bag may be necessary to secure the bag to the stand.

e) Test seal with vacuum. (Fig. 25)

4e. Consolidation

Fig. 26

a) Place brace/model under vacuum in oven for consolidation, maintain maximum vacuum in oven (Fig. 26).

b) Do not let vacuum bag touch interior of oven or metal vacuum line to avoid rupturing.

c) Place model in center of oven.

d) Oven should be set to 425ºF (435ºF max).

e) Heating times vary depending on the cast size, moisture content and oven, average heating time is 30-45 min.

f) Forced air convection ovens are recommended for best results, standard convection ovens can be used. Note: Mold may need to be rotated in oven several times if using a standard convection oven.

5. COOL DOWN

Fig. 27

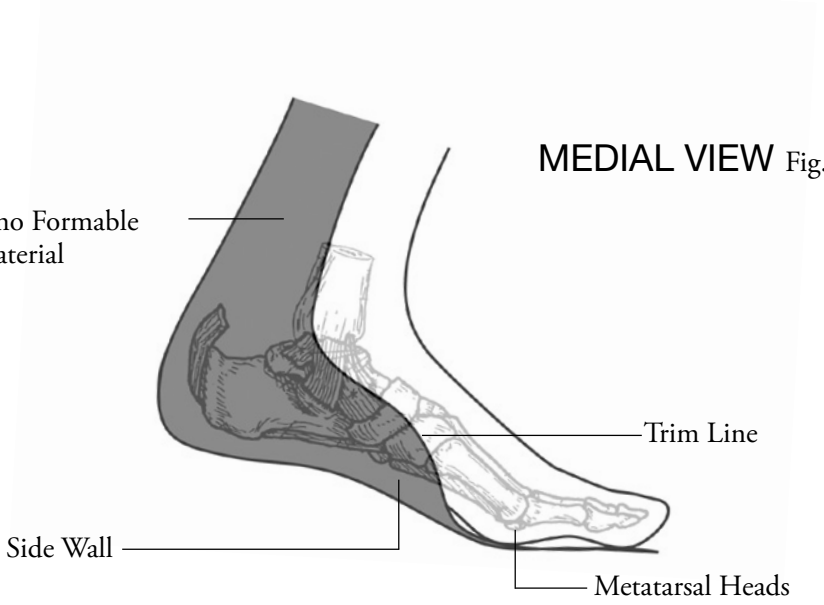
Fig. 28

a) Remove model from oven to allow cooling at room temperature, do not remove brace from vacuum until cool to touch (Fig. 27).

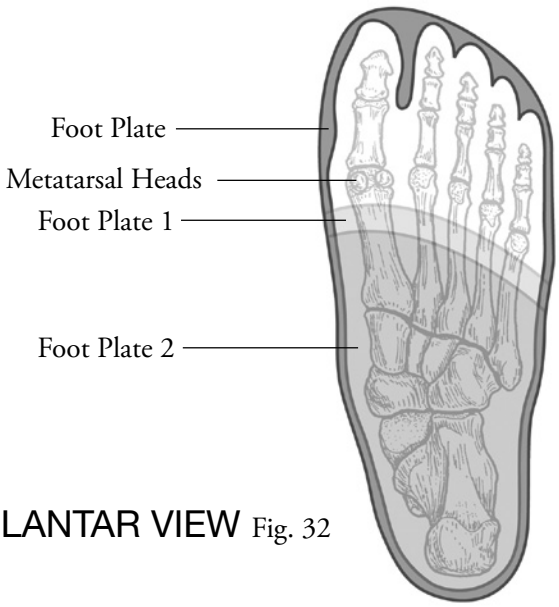
b) Remove vacuum bag and silicone sheeting with caution to avoid damage to silicone sheeting for reuse.

c) Remove excess material and lightly sand edges of brace to complete fabrication (Fig. 28).

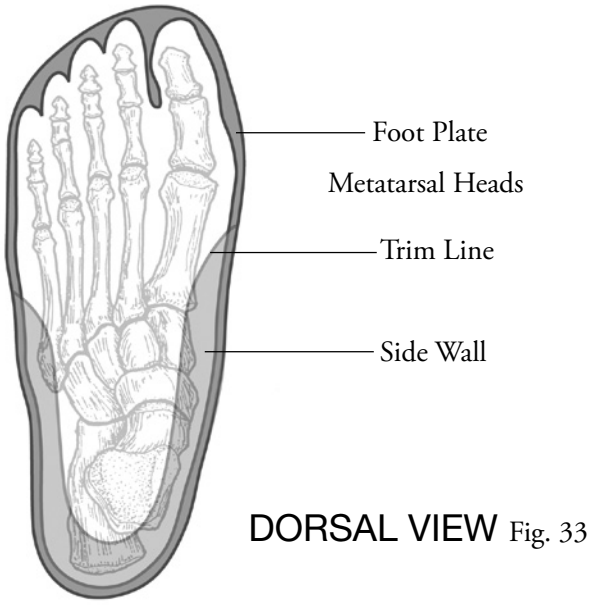
Full Length Foot Plate Construction



MEDIAL VIEW Fig. 31



PLANTAR VIEW Fig. 32



DORSAL VIEW Fig. 33

a) Place the full length foot plate in a sandwich-like construction between foot plate 1 and 2 as shown in the plantar view diagram above (Fig. 32). Foot plate 1 and 2 should extend just posterior to the metatarsal heads and be staggered backwards and should not extend past the metatarsal heads. This will allow the full length foot plates to bend without restriction. It is recommended that the side walls of the brace should not extend past foot plates 1 and 2.

b) Trim the side walls of the brace to be posterior to the metatarsals by 1/4" - 3/8" to allow the foot plate to bend without any restrictions from the side walls. The more the side walls are trimmed back the better results you will have from the foot plate. This will greatly increase the life of the brace in the foot plate region. Trim the side walls as shown above in the medial and dorsal view diagrams above (Fig. 31 and 33).

NOTE: Full-length foot plate materials are sold separately from our kits and are available on the bottom of page 9.

Molding Process for Preformed TFC Foot Orthotics

1. HEATING

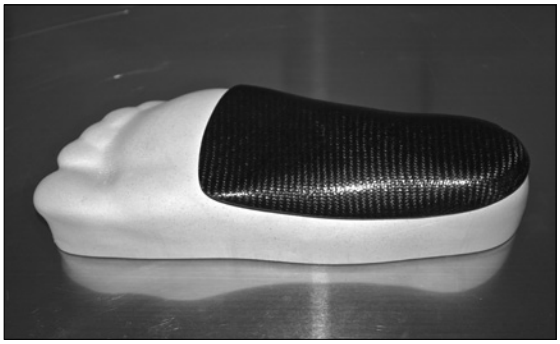


Fig. 1

a) Prepare and modify foot mold as usual and form appropriate soft full length insole.

b) Pre-determine placement of the TFC preformed blank on insole. Trim back excess TFC material as necessary. Blank should not extend past metatarsal heads. (Fig. 1)

Fig. 2

c) Place foot orthotic blank in a preheated oven at 400° for approximately 1 minute. (Fig. 2) TFC should become malleable after 1 minute. Do Not over heat TFC material. This could lead to weakening and failure of orthotic. Heating times may vary based on type of oven being used. Blank can be heated with a conventional heat gun if an oven is not available.

2. MOLDING

Fig. 3

a) A vacuum press works best to apply pressure to blank in the remolding process. Place heated blank on mold and carefully position in desired orientation. Blank can also be held in place by hand (using thermoforming gloves). (Fig. 3)

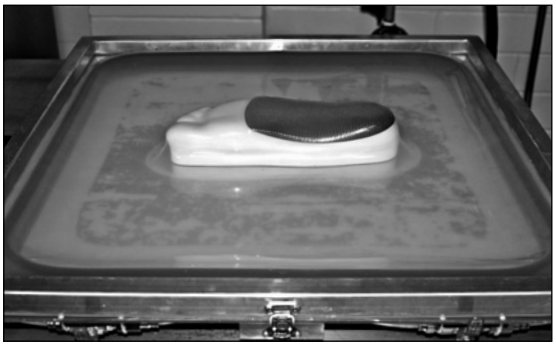


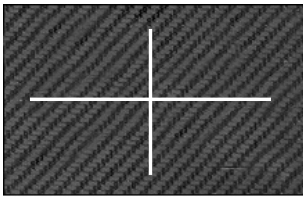
Fig. 4

b) Once the heated blank is in position, close the vacuum press. (Fig. 4) Allow TFC orthotic to cool for approximately 3 minutes. Insole material can be glued to TFC with contact cement after molding.

Fabrication Materials and Services

3-D FORM

3-D= The same strength in 0° and 90° directions. Good for difficult shapes like the heel.

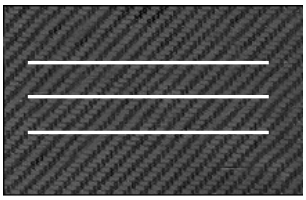


Product No.	Description		Use
700010121	COMFIL® 3-D Form Glassfiber, Black	1000x600x.75mm	Good for opening flaps
700010122	COMFIL® 3-D Form Glassfiber, Black	1000x600x1.5mm	Good for flexible toe off parts
700010123	COMFIL® 3-D Form Glass and Carbon Fiber	1000x600x1.5mm	Good for rigid foot plate, arch support
700010124	COMFIL® 3-D Form Carbon Fiber	1000x600x.7mm	Good for difficult shapes and strengthening
700010125	COMFIL® 3-D Form Glass and Carbon	1000x600x2.1mm	Good for foot orthotics
700010127	COMFIL® 3-D Form Carbon Fiber	1000x600x0.5mm	Good for difficult shapes and strengthening

* 3D = Bi-Directional

U-D FORM

U-D= Maximal strength in one direction. Good for bars, insoles and strengthening.



Product No.	Description		Use
700010103	COMFIL® Complex UD Form Carbon and Glassfiber	1000x600x2.55mm	Good for rigid insoles and uprights
700010101	COMFIL® Complex UD Form Carbon	1000x600x1.6mm	Good for bars and other rigid parts
700010126	COMFIL® Complex UD Form Carbon	1000x600x0.7mm	Good for multi-layering

* UD = Unidirectional

3-D FORM

- Pre-formed for better fit on heel
- 3/4 Length
- May be easily customized to patient's model
- Remoldable Carbon Composite
- Extremely durable and tough

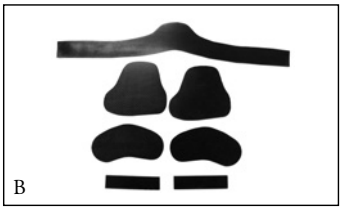
Product No.	Description (sold as pair)	Unit	Men's	Women's
024021	Preformed TFC Foot Orthotics	PR	4	5 - 6
024022	Preformed TFC Foot Orthotics	PR	5 - 6	7 - 8
024023	Preformed TFC Foot Orthotics	PR	7 - 8	9 - 10
024024	Preformed TFC Foot Orthotics	PR	9 - 10	11 - 12
024025	Preformed TFC Foot Orthotics	PR	11 - 12	13 - 14

INSOLES AND ARCH SUPPORT BLANKS

Flexible Insole= 1.5mm thickness. Best for tight radii such as the heel.
Rigid Insole= 2.5mm thickness. Best for general shaping such as the arch.

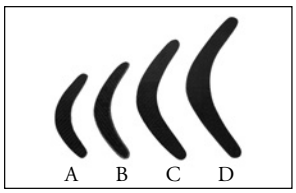
Product No.	Description	Length	Men's	Women's
Unidirectional Material				
700030141	COMFIL® Rigid Insoles, (sold as pair)	25 cm	3.5 - 5	5 - 6.5
700030142	COMFIL® Rigid Insoles, (sold as pair)	26.5cm	6 - 7.5	7.5 - 9
700030143	COMFIL® Rigid Insoles, (sold as pair)	28.5cm	8 - 9	9.5 - 10.5
700030144	COMFIL® Rigid Insoles, (sold as pair)	30cm	10.5 - 12	12 - 13.5
Bidirectional Material				
700030121	COMFIL® Flexible Insoles, (sold as pair)	25cm	3.5 - 5	5 - 6.5
700030122	COMFIL® Flexible Insoles, (sold as pair)	26.5cm	6 - 7.5	7.5 - 9
700030123	COMFIL® Flexible Insoles, (sold as pair)	28.5cm	8 - 9	9.5 - 10.5
700030124	COMFIL® Flexible Insoles, (sold as pair)	30cm	10.5 - 12	12 - 13.5
700500	COMFIL® Rigid Arch Support Blank, full length, (sold each)	23.5cm	- -	- -
700520	COMFIL® Rigid Arch Support Blank, full length, (sold each)	27cm	- -	- -
700530	COMFIL® Rigid Arch Support Blank, full length, (sold each)	31cm	- -	- -
700540	COMFIL® Flexible Arch Support Blank, full length, (sold each)	23.5cm	- -	- -
700550	COMFIL® Flexible Arch Support Blank, full length, (sold each)	27cm	- -	- -
700560	COMFIL® Flexible Arch Support Blank, full length, (sold each)	31cm	- -	- -

PRE-FAB KITS



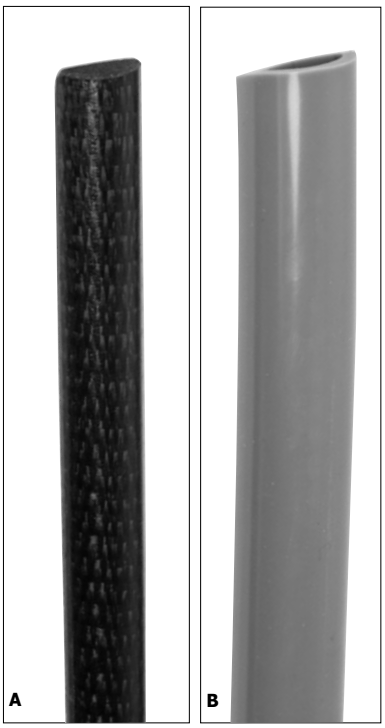
	Product No.	Description	Size
A	700000	TFC Solid AFO	Small
A	700005	TFC Solid AFO	Medium
A	700010	TFC Solid AFO	Large
--	700050	TFC Floor Reaction AFO Kits	Small
--	700060	TFC Floor Reaction AFO Kits	Medium
--	700070	TFC Floor Reaction AFO Kits	Large
B	700200	TFC Pediatric AFO Kit	- -

ANKLE INSERTS



	Product No.	Description	
A	700100	Small, Length 4-1/4"	0.060/1.5mm
B	700110	Medium, Length 5-1/4"	0.100/2.55mm
C	700120	Large, Length 6-1/4"	0.100/2.55mm
D	700130	Extra Large, Length 7-1/4"	0.100/2.55mm

TFC ORTHOTIC UPRIGHTS



- Stronger and lighter than conventional metal uprights
- Thermoformable contouring using heat gun or oven
- Accommodates smaller radii bends
- Increased stiffness and flexibility of Carbon Composite
- Will not corrode unlike conventional metal uprights
- Uses innovative post pre-preg Carbon material
- Optimized attachment plates for conventional metal joints

	Product No.	Description
A	700600	TFC Orthotic Upright
B	700610	19” Silicone Forming Sleeve
	700620	Flat Plate for Double Action Ankle Joint
	700630	Contouring Foam

Please note: Fabrication of the TFC Orthotic Uprights requires a Silicone Forming Sleeve and a Flat Plate, fabricating uprights without listed items will void warranty.

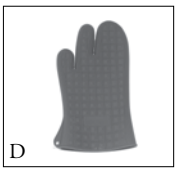
TFC ORTHOTIC UPRIGHTS FABRICATION

	Product No.	Description
	502610	TFC Orthotic Uprights with Fabrication

*Price does not include shoework, ankle joints or leather work.

EQUIPMENT


A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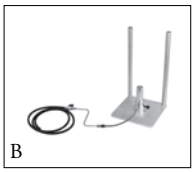
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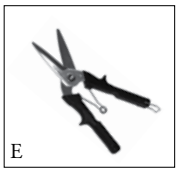
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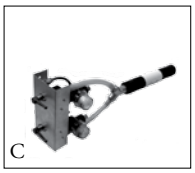
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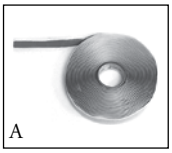
F

	Product No.	Description	Unit
A	34870	Steinel Heat Gun HG2310LCD	EA
B	600500	Consolidation Stand	EA
C	700000007	Vacuum Ejector X 2 including Muffler	EA
D	700070010	Silicone Working Glove	EA
E	600350	TFC Scissors	EA
--	700000008	Water Rejection Filter including Hose	EA
F	600345	Rubber Coated Heat Resistant Gloves	PR
G	600355	Silicone Hand Roller 1.5" wide	EA


G

FABRICATION MATERIALS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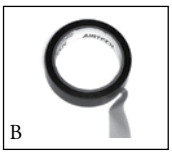
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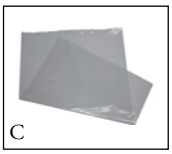
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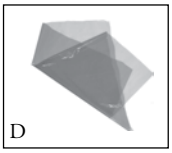
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H

	Product No.	Description	Size
A	600311	Green Double Sided Bag Tape	EA
B	600315	TFC 1" High Temp Stretch Tape	EA
C	600331	Vacuum Bag KIT - DPT - 1000	PK
D	600335	Red Inner Release Thin Film A4000R Ordered by the Foot x 25”	FT
E	700070021	COMFIL® L-Pet Stockinette	10cm width
E	700070024	COMFIL® L-Pet Stockinette	18cm width
F	700070031	PET-Black High Temp Stockinette	10cm width
--	700070034	PET-Black High Temp Stockinette	18cm width
G	600320	Silicone Sheeting (unit EA. .031)	36" x 36"
--	700000105	Silicone Bag for Expansion Chamber	Small
H	700000107	Silicone Bag for Expansion Chamber	Medium
--	700000109	Silicone Bag for Expansion Chamber	Large
--	600300	TFC Fabrication Starter Kit (includes A,B,C,D,G)	EA
--	600319	TFC Silicone Sheeting For Bladders .063	36"x36"

CENTRAL FABRICATION SERVICES

SOLID AFO WITH RIGID TOE*

Product No.	Description	Size
501110STFC	AFO with Solid Rigid Toe	Small
501110MTFC	AFO with Solid Rigid Toe	Medium
501110LTFC	AFO with Solid Rigid Toe	Large

FLOOR REACTION AFO*

Product No.	Description	Size
501130STFC	Floor Reaction AFO	Small
501130MTFC	Floor Reaction AFO	Medium
501130LTFC	Floor Reaction AFO	Large

*C-Fab Item - price subject to change

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