
ICEX Training Manual, Version 3

– using ICECAST Compact –

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ICEX Socket System

ICEX concept involves direct casting, fabrication and fitting of a total surface bearing transtibial socket in one session. It utilizes ICECAST Compact pressure casting apparatus.



INTRODUCTION

ICEX is a technique that combines casting, manufacturing and fitting of a prosthetic socket in a single session. It consists of an ICEX carbon braid, a special socket lock and pin assembly and utilizes the ICECAST Compact casting instrument. The process involves using a specially prepared ICEX carbon braid which directly produces a well-fitting prosthetic socket over the residual limb. A distal attachment is incorporated into the ICEX carbon braid onto which a socket lock assembly is fitted. The socket lock assembly will interface with other commonly used prosthetic hardware.

Silicone Pressure Pads eliminate the need for build-ups or reliefs in the socket. They provide a similar function, but do not affect the socket volume and are incorporated into the socket structure during the casting procedure.

ICECAST Compact is a pressure casting tool that allows casting pressure to be applied via an inflatable silicone bladder which is rolled onto the prepared residual limb. There is a locking mechanism for a socket lock pin that is fitted to the ICEROSS silicone liner. This connects the residual limb to ICECAST Compact during the casting procedure.

Under pressure there is a tendency for tension to be applied to the end of ICEROSS, effectively elongating the residual limb. This stiffens the mechanical coupling between the rigid structure of the prosthesis and the soft tissues. This effect can be enhanced by slightly preloading of the ICEROSS covered residual limb prior to pressurization. The resulting displacement can be monitored by a tension meter in the pump handle. This balanced system of forces created by the distal tension will enhance the suspension of the socket.

The pump unit, tension meter and pressure gauge are built into the pump handle to create a compact unit that is easy to use. The bladder and the pump handle are connected by a quick release coupling. A pressure release valve is located by the pressure gauge.

The casting process takes less than ten minutes and produces a socket that is ready for trimming and assembling. The time and workshop involvement saved is considerable and it is possible to have your amputee walking on a prosthesis with a well-fitting prosthetic socket, ready for finishing, within one hour from the beginning of the clinical session.

INTRODUCTION

Background

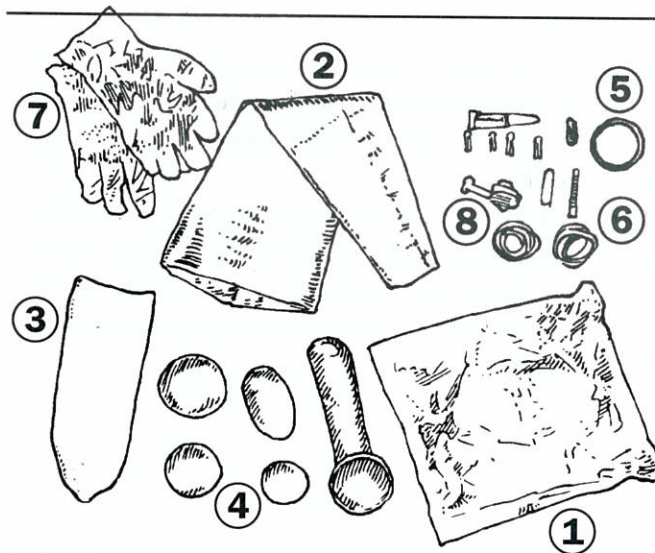
Principles of hydrostatic weight bearing have been discussed for many years. The common understanding is that within the residual limb, there is a longitudinal internal piston action by the skeletal element whose upward movement, with respect to the socket, is limited by internal tissue connections. Downward movement of the skeleton would be prevented by the incompressible nature of the residual limb tissues whose volume is contained within a rigid socket.

Redundant soft tissues in a residual limb can serve as a medium for weight bearing. Soft tissues are incompressible and deformations are made at constant volume. The main requirement of soft tissue weight bearing is that the residual limb must be contained in a vessel of the correct volume that has resistance to change. An analogy can be drawn to stiffness in a hydraulic system which is defined as having resistance to volume change.

The most efficient way to exploit this in a prosthetic socket is by utilizing a silicone socket with a distal attachment (ICEROSS) as an interface between the residual limb and the rigid socket.

The residual limb can effectively be elongated by pulling the skin envelope until most relative motion between skin and skeleton has been eliminated. If the residual limb in this form can be fitted into a snug, tightly fitting container, a weight-bearing system, stiff enough to support body weight in a lower limb prosthetic socket, is presented. This system is elastic in the first phase of loading but once full loading has been achieved the system becomes stable. Some of the mass flows out of the container e.g. above the posterior shelf in a trans-tibial socket. However when it stabilizes, it becomes very stiff and hence stable.

ICEX COMPONENTS AND TOOLS



ICEX Socket System includes:

1. ICEX Carbon Fiber Braid
2. Inner cover
3. Interface sheath
4. Pressure Pads
5. Aluminum ring
6. Edge tape
7. Pair of latex gloves

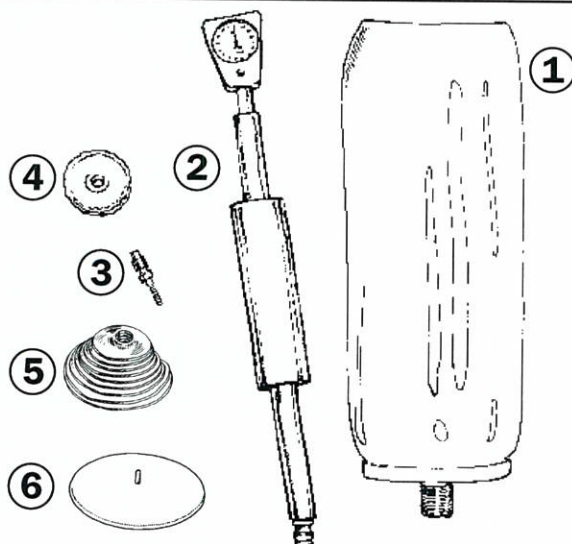
It is possible to order all items separately (see Össur Product Catalogue)

ICEX Socket System Prod. #:

X-022140, X-022150

X-023040, X-023050

Locking mechanism not included. For selection of locking mechanism, see information on ICELOCK 100 Series on page 18.



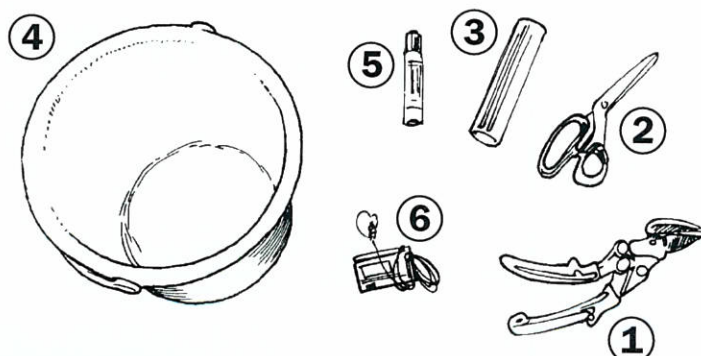
ICECAST Compact includes:

1. Bladder
2. Pump handle
3. Connecting pin
4. Puck-stabilizing tool
5. Silicone discs
6. Stand

Prod. #:

D-040400 ICECAST COMPACT
WITH STANDARD BLADDER

D-040404 ICECAST COMPACT
WITH LARGE BLADDER



ADDITIONAL TOOLS NEEDED (NOT SUPPLIED):

1. Cutters (or jigsaw)
 2. Scissors
 3. Cling film
 4. Water container
 5. Marker pen
 6. Thermometer
- Water

Prod. #:

X-990660 CUTTERS, right hand

X-990650 CUTTERS, left hand

X-990800 TRANSPARENT SELF-
ADHESIVE FOIL (cling film)

X-990810 THERMOMETER

ICECAST COMPACT CARE INSTRUCTIONS

The ICECAST Compact bladder unit may be cleaned using water, soap or isopropanol.

Acetone may be used to remove any resin left on the tube of the pump. It is important to ensure that acetone does not come into contact with the glass face of the pressure gauge.

The ICECAST Compact bladder should never be left in the reverse position for a long time. If the bladder is allowed to deflate in this position, it is difficult to reinflate.

It is also important to ensure that the ICECAST Compact unit does not fall on the floor. The disc at the end of the bladder can cause damage to the bladder, as well as cause breakage of the pressure gauge.

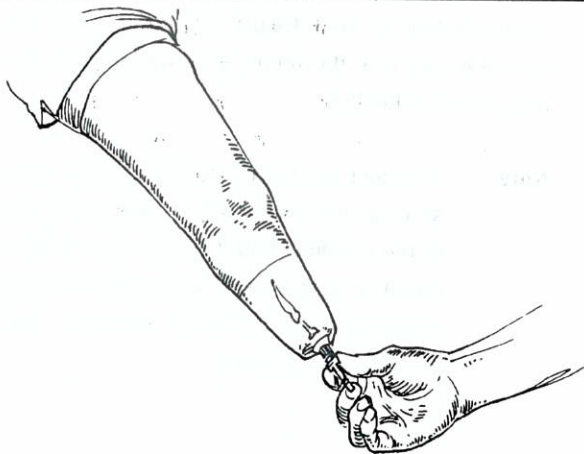
PREPARATION

Some ICEROSS users may be familiar with ICECAST equipment and techniques. Nonetheless, it is important to explain to the amputee the nature of the procedure and obtain verbal consent to proceed. The prosthetist should explain that there is going to be considerable pressure during the casting process and if this becomes intolerable it is possible to lower it. At the same time the prosthetist should ask for co-operation as the assistance of the amputee may be needed during the course of the procedure. The residual limb is checked for any contraindications relating to the use of ICEROSS and ICECAST technique. If there are none, then it is safe to proceed. If the amputee has not experienced ICECAST before, it is advisable to carry out a full pre-casting procedure to establish that the intended casting procedure is tolerable. If there is any doubt, consult the physician.

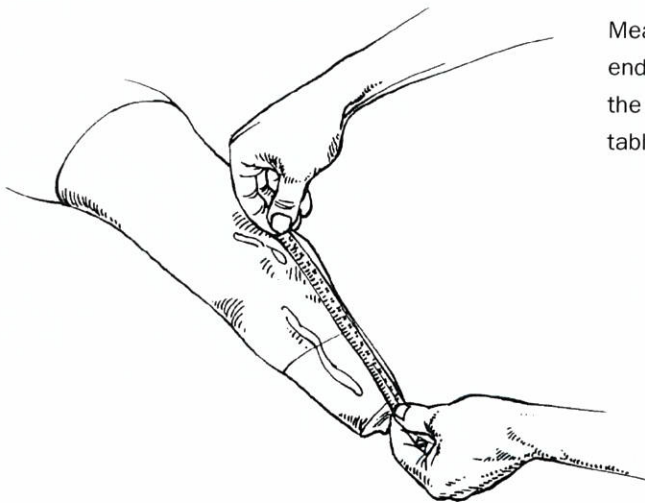
In preparation for the ICEx procedure it is important to make sure that the amputee is wearing the correct size of ICEROSS.

Note: To select the correct ICEROSS size, measure approximately 40mm above the end of the residual limb. Choose size as measured or next below. For a more detailed description of ICEROSS Concept, see Össur Training Binder.

PREPARATION



Fit the connecting pin from ICECAST Compact (D-040400/4) to ICEROSS. The pin should follow the longitudinal axis of the residual limb. This is very important for easy access of the pin into the ICEX locking system. Subjective assessment of the soft tissue stability of the residual limb under ICEROSS is carried out by gently pulling the pin. The amount of movement gives an indication of the stability.



Measure the length of the residual limb from distal end to the proximal aspect of the patella. Choose the correct size of the ICEX carbon braid from the table below.

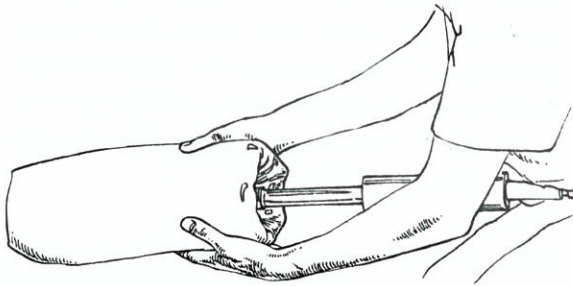
ICEX Carbon braid is available in four sizes corresponding to the appropriate ICEROSS sizes and residual limb lengths.

Quote the corresponding part number when ordering your ICEX kit.

ICEX PROD #	ICEROSS SIZE 18-32	ICEROSS SIZE 30-45
STUMP LENGTH <40 cm	X-012140	X-013040
STUMP LENGTH <50 cm	X-012150	X-013050

Note: The majority of transtibial amputees use ICEX product # X-012140.

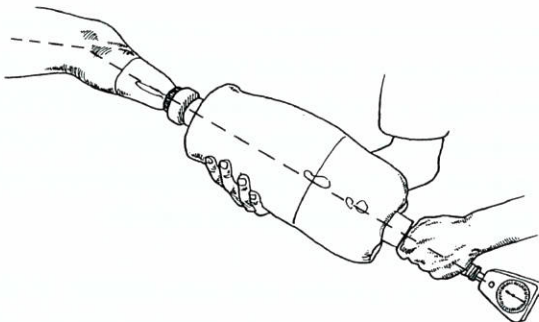
PREPARATION



Screw the puck-stabilizing tool from ICECAST Compact (D-040400/4) onto the connecting pin. Connect ICECAST Compact pump handle to the bladder and inflate to 20mmHg. Reverse the bladder to expose the socket lock by resting the gauge on your hip and pulling the bladder towards you with both hands.

- Note:** (i) Never leave the bladder in the reversed position for a long time. Should the bladder deflate in this position, it is difficult to reinflate.
- (ii) Be careful not to let the bladder fall. The disc at the end of the bladder can cause damage to the bladder.

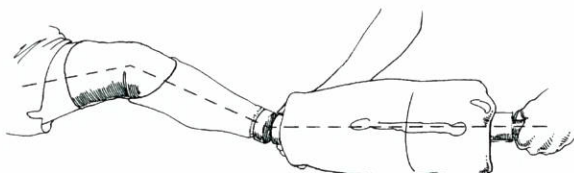
Correct alignment



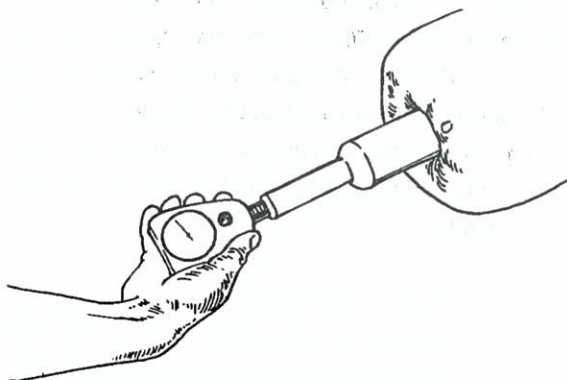
Connect ICECAST Compact unit with reversed bladder to ICEROSS. Ensure that the pin is fully engaged with the locking mechanism in the bladder.

- Note:** (i) Ensure that ICECAST Compact is aligned along the longitudinal axis of the residual limb to prevent misalignment of the distal end of the socket.
- (ii) The amputee should have the knee in relaxed extension.

Wrong alignment

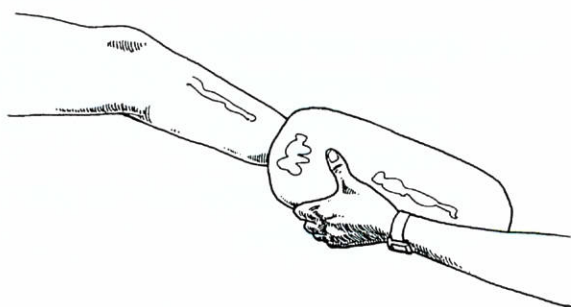


PREPARATION



Assess the distal displacement required during casting. Pull on the handle of the pump. Watch the end of the residual limb and when the preferred distal displacement is achieved, make a note of the value on the gauge. This value is used when the ICEX socket is being fitted.

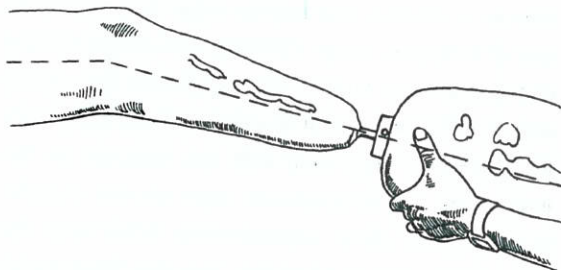
- Note:** (i) Conical residual limbs require less distal displacement due to ICECAST Compact's ability to elongate the residual limb during casting. If the residual limb is severely tapered, the distal pull should be reduced.
- (ii) Cylindrical residual limbs require maximal distal displacement, as the bladder has no additional effect on elongation.



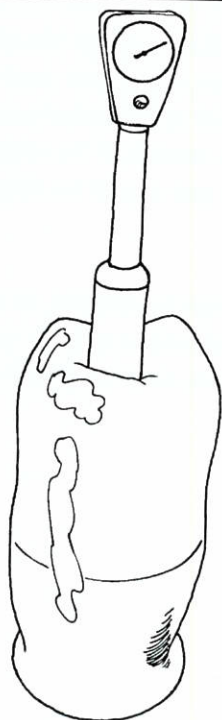
Roll the bladder on to the residual limb and pump the bladder to the desired pressure. Recommended pressure ranges are from 40 – 120mmHg. Test the pressure on the amputee for 5 minutes to be certain that the amputee tolerates the pressure.

- Note:** The pressure level used depends on the activity level of the amputee and the consistency and shape of the residual limb.

PREPARATION

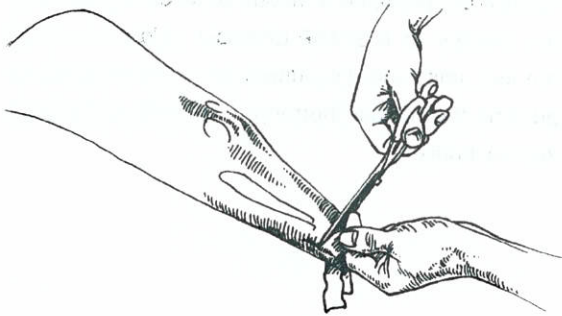


Reduce the pressure to about 30-40mmHg. Reverse the bladder of ICECAST Compact again to expose the lock unit, and disconnect the connecting pin by pushing the release button on the side of the locking mechanism.

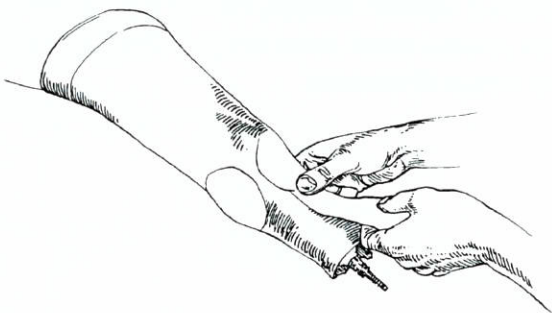


Connect ICECAST Compact locking mechanism to the provided stand, ready for use. Pressure should be around 30-40mmHg.

PREPARATION



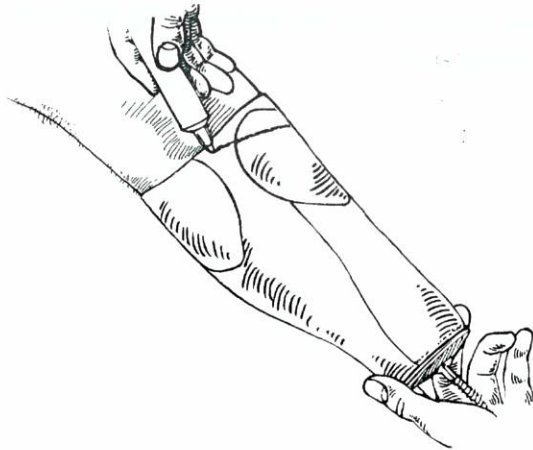
Choose a silicone disc slightly larger than the distal end of ICEROSS. Cover ICEROSS with a layer of cling film and put the correct size of silicone disc at the end of ICEROSS. Carefully pull the inner cover over ICEROSS and cling film, with the material on the inside and the polyurethane layer on the outside. Cut the inner cover approximately 5mm from the outer distal edge of ICEROSS. Tuck the silicone disc underneath the edge of the distal cover.



Place the Pressure Pads over the bony prominences and anywhere where a pressure peak is likely to occur. Pressure Pads should either be placed more than 1cm apart or overlap. If the distance is less than 1cm, a third pad should be placed over the space.

Note: Any additional pads can be placed proximal to the patella to ease removal of the ICEx socket, once the braid has hardened.

PREPARATION



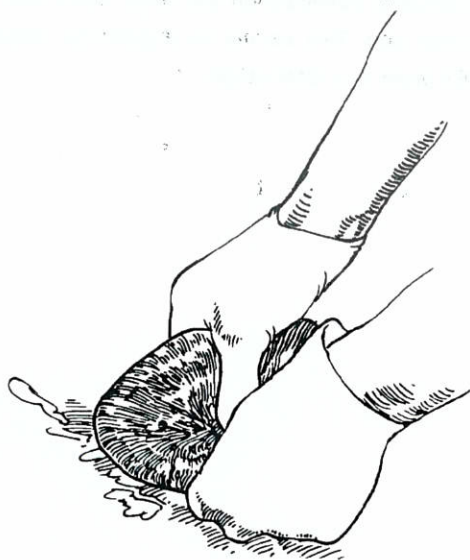
Mark expected trim-lines on the inner cover with a red marker pen. This serves as a guide for cutting the ICEX braid at a later stage.



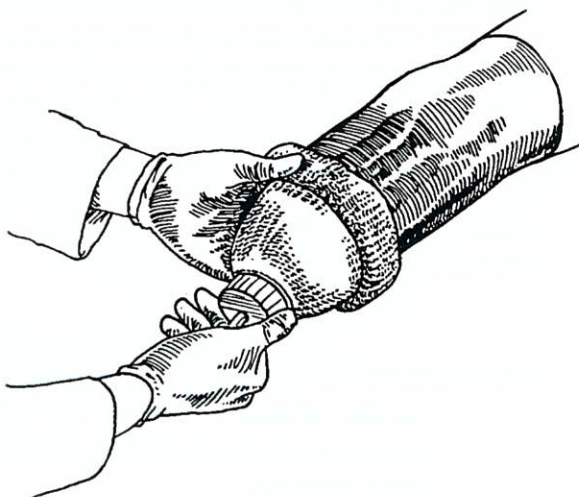
Have a container of water available at a temperature of 35°-40°C (95°-104°F). Place the aluminum ring in the puck-stabilizing tool and have this, together with scissors, close to hand. Put on the pair of latex gloves, open the foil pack containing the ICEX carbon braid and immerse the braid in the water for approximately 5 seconds, lightly massaging it to ensure full penetration of water into the braid.

- Note:** (i) After immersing the carbon braid in water, it remains workable for about 90 seconds, which gives sufficient time to complete the casting procedure.
- (ii) Be careful not to unnecessarily squeeze the carbon fibers, as they tend to stick to each other and can then be difficult to roll onto the residual limb.

CASTING

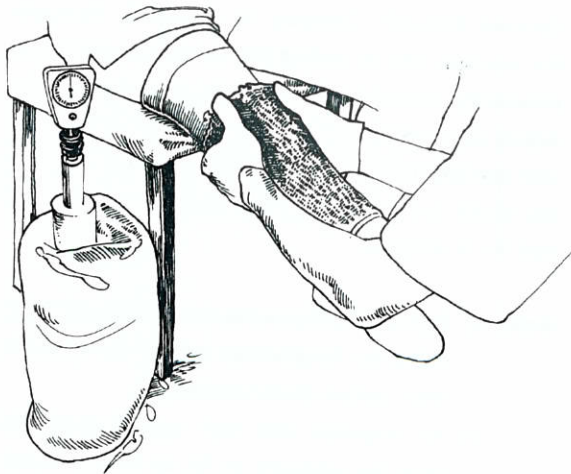


Press the puck into the aluminum ring and puck-stabilizing tool.

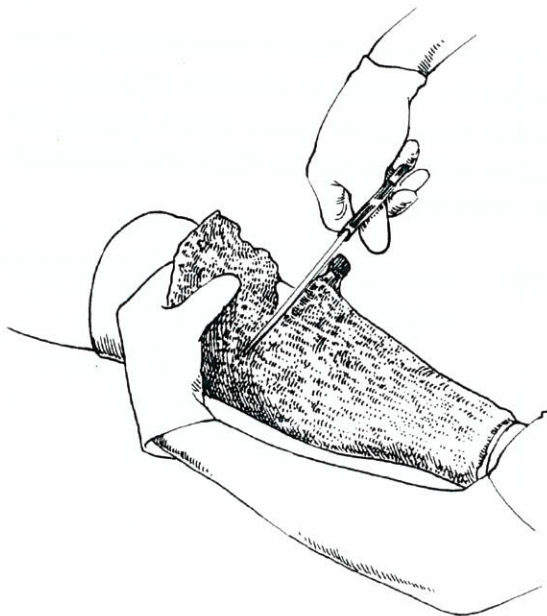


Position ICEx carbon braid onto pin at the distal end of residual limb making sure that the screw holes are in the A-P, M- L positions. Screw on the puck stabilizing tool with the aluminum ring and tighten securely.

CASTING



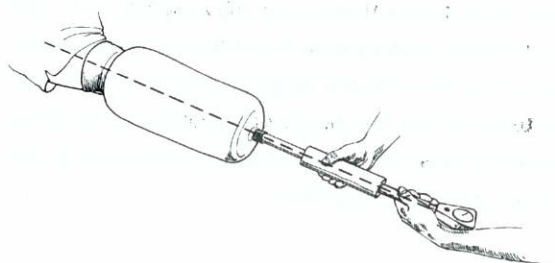
Roll ICEX carbon braid over the residual limb with both hands, making sure that it lies flat without wrinkles. Pull the material longitudinally, first in the A-P and then in the M-L position, with both hands at the proximal end, so that the material fits well to the shape of the residual limb.



Using scissors, trim the edges of the carbon material low enough to enable easy removal of the ICEX socket. Pull up the material firmly with both hands opposite each other. Smooth out the material by sliding your hands proximally two or three times.

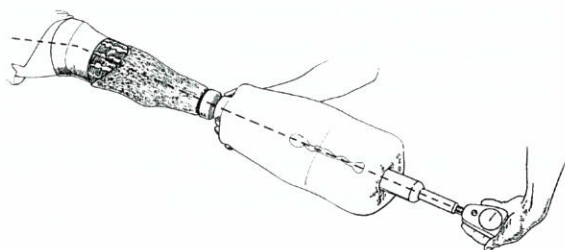
Note: Be careful not to cut below the lines marked on the inner cover.

CASTING



Connect ICECAST Compact to ICEROSS. Elongate the residual limb by pulling the tension meter to the previously recorded value. Roll on the bladder. Adjust the pressure to the previously selected level and disconnect the pump handle. Support the bladder under the middle with the residual limb in and wait for 5 minutes.

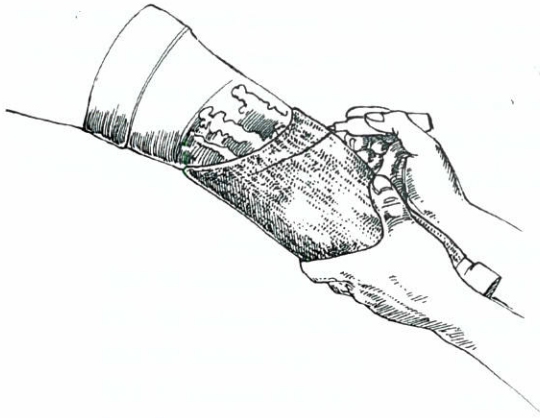
- Note:** (i) Ensure that the pump handle is positioned along the longitudinal axis of the residual limb, before disconnecting.
- (ii) An amputee with high activity level can have the pressure on for up to 8 minutes.



Reduce the pressure to 30mmHg. Roll down the bladder exposing the release button. Depress the release button and remove ICECAST Compact from the connecting pin.

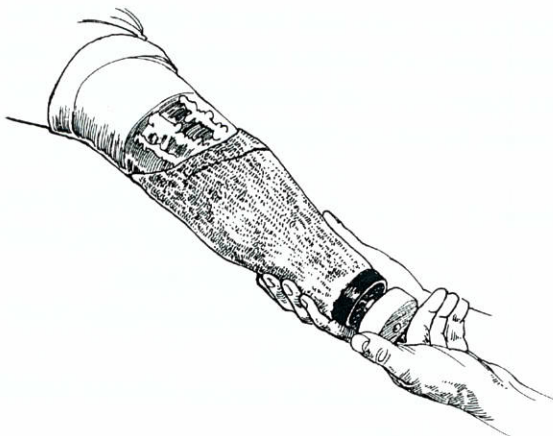
- Note:** Ensure that the bladder is aligned with the residual limb.

FINISHING



Mark the trim lines on the ICEx socket, using a marker.

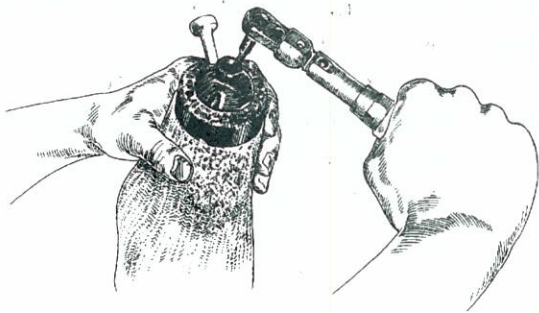
Note: Be careful not to draw trimlines too low at this stage.



Remove the puck stabilizing tool and connecting pin from the socket. Remove the ICEx socket from the residual limb by gently pulling. Ask the amputee to relax the residual limb to ease removal of the socket. Remove the silicone disc from inside the ICEx socket.

Note: Tuck the inner cover inside the socket.

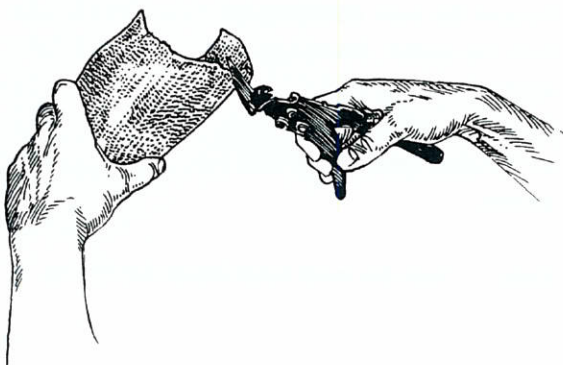
FINISHING



Remove the 4-mm hex screws from the puck at the distal end of the socket. Clean around the distal end and remove any remaining resin. Insert one of the ICELOCK locking mechanisms available according to the instructions supplied with the ICELOCK product.

ICELOCK 100 Series product #:

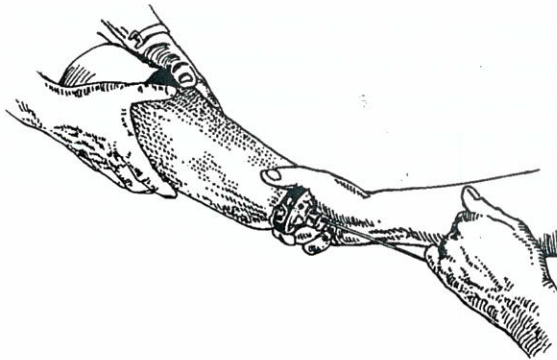
L-122000	ICELOCK ratchet TP 122
L-123000	ICELOCK ratchet SP 123
L-124000	ICELOCK ratchet 4H 124
L-132000	ICELOCK lanyard TP 132
L-133000	ICELOCK lanyard SP 133
L-134000	ICELOCK lanyard 4H 134
L-142000	ICELOCK valve TP 142
L-143000	ICELOCK valve SP 143
L-144000	ICELOCK valve 4H 144



Pull the inner cover away from the socket to the red mark (previously marked expected trimlines). Trim the edges of the ICEX socket to the trim line with the cutters. Smooth the edges with sandpaper.

- Note:** (i) In order to speed up the hardening process, run hot tap water (70°C/58°F) over the socket for 2-3 minutes.
- (ii) It is easier to cut the carbon braid 30 minutes after casting.
- (iii) A jigsaw can be used for trimming instead of cutters.

FINISHING

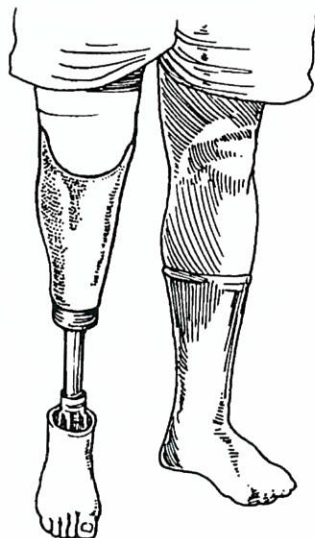


How to check the trim lines

Use a lanyard cord attached to ICEROSS and pull it through the socket. Hold the ICES socket with one hand and pull the cord down so that the residual limb gets into the correct position in the ICES socket.

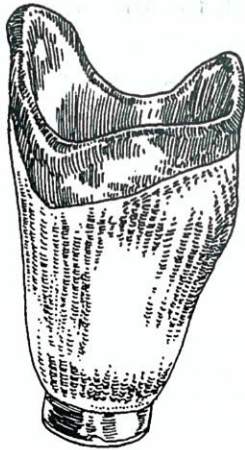
Ask the amputee to bend the knee slightly. If the amputee cannot bend the knee correctly, the posterior wall of the socket is getting in the way of the tendon.

Examine the position of both tendons and mark their position on the ICES socket. Make an accurate relief so the ICES socket is comfortable for the amputee.



Sand edges lightly. Apply the edge tape. Assemble the distal components of the prosthesis. Allow the amputee to walk. Make any necessary alignments and adjustments to the trim lines until a satisfactory fit has been achieved.

FINISHING



Apply new edge tape prior to finishing the socket. Apply glue to a 1cm (0.4in) line inside the top edge of the socket and 2cm (0.8in) line on the outside top edge of the socket. Fasten the trimmed inner cover to the glue. Once this has set, give the socket a final sanding.

Finishing with Cosmetic Cover

A plastazote cosmesis covering the socket all the way up to the proximal trim line can be used. The cosmesis is blended to the trimlines of the socket. A suitable cover is applied which is glued to the proximal edge.