External Fixation.
Basic principles.

Biomechanics
Dynamization
Selected constructs
Frame biomechanics

The required strength of an external frame depends on the intended function of the fixator and the degree of fracture instability. With any frame, following the basic biomechanical principles helps to ensure a stable fixation.¹

Options to increase frame stability

a. Increase the distance between the two outermost Schanz screws in each fragment.

Note: Innermost Schanz screws should be at least 2 cm from the fracture line.

b. Increase the number of Schanz screws in each fragment.

c. Reduce the distance between the rod and bone.

d. Add a second rod or tube in the same plane, with the clamps in close contact (i.e., double-stacking).

e. Use a larger diameter Schanz screw. Increasing the diameter by 1 mm more than doubles the stiffness and nearly doubles the strength.

In the tibia, since sagittal bending moments are approximately two to five times greater than those in the coronal plane, placing the frame in the sagittal plane will increase frame stability. To be mechanically effective, the stiffness of the external fixation frame should match the forces and moments at the fracture site. This sagittal-to-coronal stiffness ratio can be achieved if the Schanz screws are oriented in the AP direction.²

Note: The same factors that increase frame stability for unilateral frames apply to modular frames.

² Ibid.
**Dynamize the frame**

Dynamization is the process of altering the frame so that one larger fragment can move axially in relation to the other, while movement in all other planes remains restricted. This allows load transference to the fracture site while maintaining anatomic alignment. This functional loading appears to increase the strength of the callus and decrease the need for immobilization after frame removal.4

In order to create dynamization, the frame must be double-stacked, with rods in the same plane as the axis of the bone. “Crosswise release,” or the loosening of adjacent clamp nuts on a frame, permits dynamization.

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4. Ibid.
Dynamize the frame continued

Dynamization with Adjustable Clamps (393.64)
Numbers denote nuts that must be loosened.

Figure A
1. Loosen the nut on the outer universal joint for two-tubes.
2. Loosen the nuts on the rod side of the inner proximal clamps.

or

Figure B
1. Loosen the nuts on the rod side of the outer distal clamps.
2. Loosen the nuts on the rod side of the inner proximal clamps.

Dynamization with combination clamps
1. Loosen the bolts on both outer proximal clamps.
2. Insert dynamization clips between the rod vise plates and retighten the bolts.
3. Loosen the bolts on both inner distal clamps.
4. Insert dynamization clips between the rod vise plates and tighten the bolts.

The frame will then allow guided collapse of the fragment.
Selected External Fixator Constructs and Frame Requirements*

**Unilateral frame**
- Multi-pin clamps, 2 ea.
- Schanz screws, 4 ea.
- Carbon fiber rod, 1 ea.

**Modular frame**
- Combination clamps, 6 ea.
- Schanz screws, 4 ea.
- Carbon fiber rods, 3 ea.

* For further information, please refer to the individual frame technique guides.
Selected External Fixator Constructs and Frame Requirements* continued

**Modular bridge frame**
- Combination clamps, 6 ea.
- Schanz screws, 4 ea.
- Carbon fiber rods, 3 ea.

**Delta bridge frame**
- Multi-pin clamp, 1 ea.
- Rod attachment for multi-pin clamp, 1 ea.
- Combination clamp, 2 ea.
- Schanz screws, 2 ea.
- Steinmann pin with central thread, 1 ea.
- Carbon fiber rods, 2 ea.

* For further information, please refer to the individual frame technique guides.
<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>115.720</td>
<td>Large External Fixator Set, with self-drilling Schanz screws</td>
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<tr>
<td>115.740</td>
<td>Large External Fixator Set, with titanium self-drilling Schanz screws</td>
</tr>
<tr>
<td>115.992</td>
<td>Medium External Fixator Set, with self-drilling Schanz screws</td>
</tr>
<tr>
<td>115.994</td>
<td>Medium External Fixator Set, with titanium self-drilling Schanz screws</td>
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<td>115.982</td>
<td>Small External Fixator Set, with carbon fiber rods</td>
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<td>115.760</td>
<td>Non-Spanning Module, for Small External Fixator Set</td>
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<tr>
<td>115.985</td>
<td>Mini External Fixator Instrument and Implant Set</td>
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