

Allows Percutaneous Plate Insertion and Targeting of Screws  
in the Distal Femur

# Less Invasive Stabilization System (LISS) for LCP<sup>®</sup> Distal Femur Plates

Surgical Technique



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## **MR Information**

The Less Invasive Stabilization System (LISS) has not been evaluated for safety and compatibility in the MR environment. It has not been tested for heating, migration or image artifact in the MR environment. The safety of the Less Invasive Stabilization System (LISS) in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

 Image intensifier control

# Less Invasive Stabilization System (LISS) for LCP Distal Femur Plates

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Plate osteosynthesis in accordance with AO principles has resulted in improved restoration of full function to the injured limb and mobility to the patient. Infection, refracture, delayed union, and the need for bone graft are not uncommon, although the majority of fractures heal without complication. Developments such as closed, indirect reduction techniques; implants with minimal bone contact; development of internal fixators; and further advances in the area of extramedullary force carriers have evolved in order to limit soft tissue disruption and preserve the blood supply. The Less Invasive Stabilization System (LISS) for LCP® Distal Femur Plates is an extramedullary, internal fixation system that has been developed to incorporate these technical innovations and surgical techniques. Its main features are an atraumatic insertion technique, minimal bone contact, and a locked, fixed-angle construct.

## Biomechanics of unicortical, locked screws

### **Traditional compression plating**

Traditional bone screws in plates have relied on two forces to create stable fixation: compression between opposing cortices and friction between the plate and bone caused by the screw. A tensile force is generated along the axis of the screw. This tensile force relies on the shear strength of the bone at the screw-thread interface. In particularly hard bone, higher forces can be generated, whereas in softer, osteopenic bone, the shear strength is lower and more susceptible to stripping.

As the screw is tightened, its increasing tensile force creates increasing compressive force between the plate and bone. This compression generates a friction force between the bone and plate. Applied load is transferred from the bone to the plate, across the fracture, and back to the bone. A tight frictional interface is key to the load transmission. As long as the applied (patient) load is less than the frictional force, the construct will remain stable.

Although a bicortical screw has inherent angular stability, when the patient load exceeds the maximum friction available, some collapse across the fracture gap results. This collapse is due to the lack of angular stability between the plate and the screw.

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### **Locked screw-plate constructs**

Traditional unicortical bone screws have lower load carrying capability than bicortical screws. However, if a unicortical screw is locked to the plate, its load carrying capacity increases due to the angular stability. This locked screw-plate connection provides the path for load transmission to the plate. When comparing the load applied to a locked screw with a conventional screw, both screws are subjected to the same patient load. However, load on the bicortical, non-locked screw is always higher due to the initial tightening required to generate friction between the plate and the bone, which ensures stability of the construct.

In conventional plating, even though the bone fragments are correctly reduced prior to plate application, if the plate does not fit the bone, the result will be fracture dislocation. If a locked internal fixator is applied to a reduced long bone fracture, the alignment is maintained by the locked screw construct. A locked internal fixator functions as a splint, which relies on relative stability for secondary healing and callus formation. However, this implant does not inherently reduce or align the fracture during its placement (as with a nail). The implant locks the bone segments in their relative positions regardless of how they are reduced. Preshaping the plate minimizes the gap between the plate and the bone, but an exact fit is not necessary for implant stability.

A conventional plate must be tightened against the bone in order to generate the frictional forces needed for stability. This compresses the periosteum between the plate and the bone and theoretically compromises blood flow in the area of plate contact. With a locked internal fixator, the plate is not compressed against the bone, thus reducing or avoiding constriction of the local blood supply.

LISS for LCP Distal Femur Plates offers a locking internal fixator construct for use in the distal femur. In addition, the availability of an insertion guide allows percutaneous targeting of screws through stab incisions. The insertion guide also ensures that all screws will be properly inserted and locked to the plate.

## Traditional plating and locked internal fixators comparison

### Traditional plating

Screws tighten plate to bone to generate compression

Screw threads in bone are under a load applied intraoperatively

Patient loads (weight and movement) add to the amount of preload on the bone/plate/screw construct

### Locked internal fixators

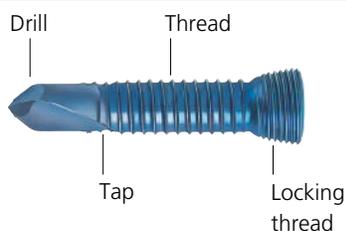
Screws lock to the plate

Screws inserted into bone with minimal axial preload

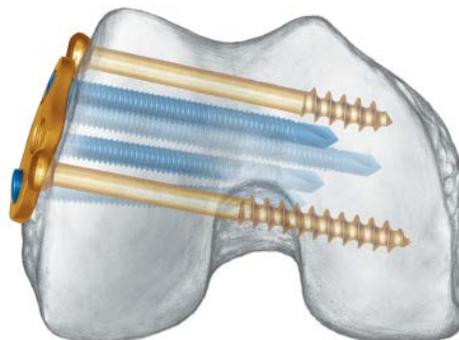
No stress in the system (bone or plate) prior to patient loads

### Features

Locking screws perform drilling, tapping and locking to the plate.



Optimized screw position in the condyles to avoid intercondylar notch and patellofemoral joint and maximize bone purchase.



Anatomic shape of the plate and locked construct makes intraoperative contouring unnecessary. Percutaneous, submuscular insertion of the plate does not disrupt the cortical blood supply.

**Precaution: Excessive and repetitive bending is not recommended as it may weaken the plate.**



# Indications

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For fixation of fractures of the distal femur.

# Preoperative Planning

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Use the AO preoperative planning template to determine the length of the plate and position of the screws. In general, the LCP Distal Femur Plate length and screw positions are selected similarly to external fixator determinations. At least four (4) screws should be placed in the intact shaft proximal to the fracture. The selected LCP Distal Femur Plate should be longer than a traditional plate.

## Screw hole inserts

### Instruments

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324.011	Distal Femur LISS Insertion Guide, left or
324.012	Distal Femur LISS Insertion Guide, right
324.019	Stopper, for LISS Insertion Guides
324.022	Insertion Sleeve

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The preoperative planning template is also used to determine which plate holes will be located at the fracture site. To prevent tissue in-growth and facilitate implant removal, 5.0 mm screw hole inserts may be used to fill plate holes that will not be used. Screw hole inserts should be placed prior to plate insertion and the corresponding distal femur LISS insertion guide holes marked with stoppers. If a screw must replace a screw hole insert intraoperatively, the insert can easily be removed through an insertion sleeve.

**Precaution: Plate bending is not recommended as this may weaken the plate and the plate-screw interface and can compromise the targeting function of an aiming arm, if in use. However, there may be cases in which plate bending is clinically necessary. In such cases, the plate should only be bent to fit proximal femur anatomy and only bend the plate incrementally and between screw holes using the plate bending press (329.30), and never bend back-and-forth. Insert at least one screw distal to the bend.**

# Screw Selection

The plate shape, and screw angles and lengths were developed from computerized tomography (CT) of cadaver bones. As a result, a reference measurement guide for distal screws, below, was developed. Screw lengths may also be determined by measurement over a Kirschner wire (see “Measuring for distal screw length” on page 27) or direct measurement from an x-ray.

## Determining distal screw lengths (alpha holes A–G)

### Instruments

292.699	2.0 mm Kirschner Wire, 280 mm
324.037	2.0 mm Kirschner Wire Measuring Device
324.055	2.0 mm Kirschner Wire Insertion Sleeve

Measure the maximum condyle width in AP projection. This can be measured directly from an x-ray or using a 2.0 mm Kirschner wire through the 2.0 mm Kirschner wire insertion sleeve and the 2.0 mm Kirschner wire measuring device. If injured femoral condyles are not intact, a measurement can be obtained from the contralateral femur.

## Alternative technique

### Instrument

324.056*	X-Ray Calibrator
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The x-ray calibrator can be used to determine the magnification factor. The x-ray calibrator is 50 mm wide and can be used as a reference measurement to determine x-ray magnification. With the calculated magnification factor, a measurement from an x-ray can be used more accurately to calculate the actual width of the condyles.



Letters (A–G) are used to identify distal plate holes.  
Numbers (1–13) are used to identify diaphyseal plate holes.

\*Also available.

# Screw Selection

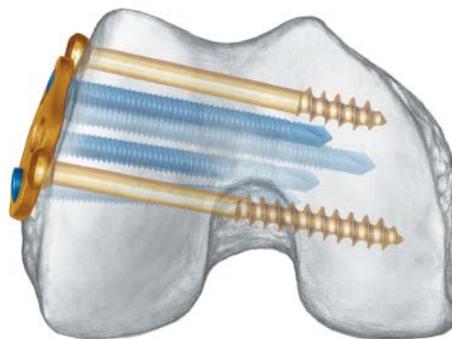
Select condylar screw lengths (A–G) from the chart below.

Width of condyles	60 mm–80 mm	81 mm–87 mm	88 mm–95 mm	96 mm–110 mm
Screw selection	Screw length (mm)			
Hole A	65	75	75	85
Hole B	40	40	55	65
Hole C	40	55	65	75
Hole D	55	65	65	75
Hole E	65	75	75	75
Hole F	65	75	75	85
Hole G	55	65	75	85

The recommended distal screw lengths and angles ensure that screws do not penetrate the far cortex or the intercondylar notch when the plate is placed properly. The screw lengths may be adjusted as necessary based on plate position and patient anatomy.

Proper placement of the LCP Distal Femur Plate on the lateral condyle is essential for correct length and position of locking screws.

In the diaphysis, 26 mm screws are generally used. If the plate is off the bone by more than a few millimeters, 40 mm screws may be necessary. In the case of very thick or dense cortical bone, refer to page 34 for additional screw insertion information.



# Patient Positioning

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Place the patient in the supine position on a radiolucent table. Adequately support the knee, but allow the leg to move freely. It may be helpful to place a small bump under the patient's buttock on the injured side. It is also important to ensure a true lateral fluoroscopy of the femur can be obtained in this position.

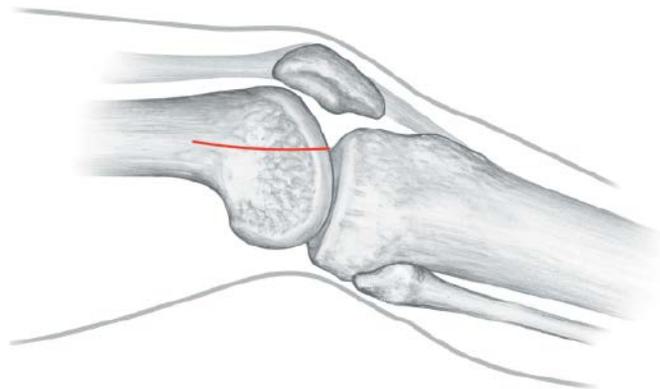
Avoid strong traction and a fully extended knee because forces of the gastrocnemius muscle will create recurvatum of the distal fragment. To reduce the muscle forces of the gastrocnemius, flex the leg approximately 20°–40°. (See the "Reduction" section for more information.)

# Incision

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## Lateral incision

A lateral incision is recommended when a simple articular (AO classification 33-C1) or extra-articular fracture (AO classification 32- or 33-A) is present. The skin incision starts at Gerdy's tubercle and extends about 80 mm in a proximal direction. The incision can be extended distally if necessary.



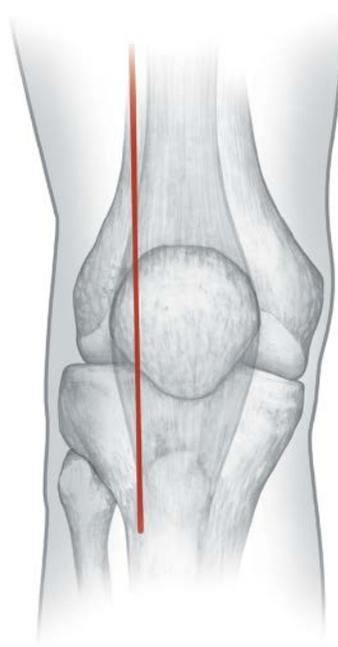
## Lateral parapatellar incision

In the presence of a complex intra-articular fracture (AO classifications 33-C2 or C3), perform a lateral parapatellar approach. Perform an arthrotomy to expose the joint for reduction. Evert the patella and extend the incision for adequate exposure of the joint for reduction and anatomic fixation.

Split the iliotibial band in line with the fibers. Define the distal margin of the vastus lateralis muscle. Open the space between the vastus lateralis and the periosteum. The plate is inserted into the virtual space between the periosteum and the muscle.

**Note: In rare instances, it may be determined that a closed insertion procedure is not appropriate. The LCP Distal Femur Plate may be applied in an open procedure to take advantage of the low-contact plate and fixed-angle construct. This is also a useful technique when reduction cannot be achieved otherwise.**

**Precaution: The incision can be extended if necessary to improve visualization of the articular surface or lateral metaphysis and diaphysis. It may not always be appropriate to use limited incisions and closed reduction techniques.**



# Reduction

Articular fracture reduction must be complete prior to placement of the LCP Distal Femur Plate. Lag screws are used to reduce the articular surface. Screw placement should take the preoperative plan for LCP Distal Femur Plate and locking screw locations into account. The figure at right shows possible sites for lag screws placed around the LCP Distal Femur Plate. (These screws may also be placed medially to laterally.)



Before locking screws are placed in each main fragment, length, rotation, varus-valgus and recurvatum correction should be achieved. Extra-articular reduction is accomplished by indirect means (e.g., external fixator, distractor, traction, joysticks, bumps, etc.). The metaphyseal/diaphyseal component of the fracture can be aligned by manual traction, a knee-bridging fixator, or a distractor. Anteromedial insertion of a Schanz screw can help manipulate the distal fragment as a “joystick.” (The use of two Schanz screws will prevent fragment rotation.) The Pull Reduction Instrument (324.033) is available to aid in minor varus-valgus and translation corrections prior to screw placement (see pages 20–22).



- Perform reduction under C-arm guidance and assess in both the AP and lateral views. Confirm reduction prior to plate insertion. Because of the gastrocnemius muscle’s pull, the distal fracture fragment may be in hyperextension on the lateral projection. If distal fragment orientation is not confirmed, the fixation may be inadvertently malpositioned. Bumps placed under the distal femur are useful in counteracting this hyperextension deformity.

An external fixator can serve as preliminary fixation. This will not only make operative reduction easier, but the fixator can also be used as a tool intraoperatively.

# Instrument Assembly for Insertion

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## 1. Assemble insertion guide

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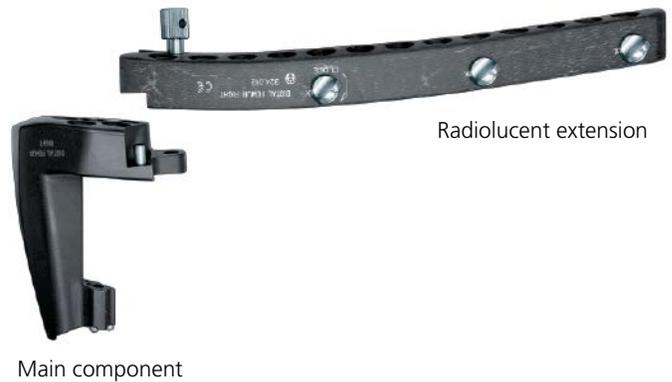
### Instrument

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324.011	Distal Femur LISS Insertion Guide, left
or	
324.012	Distal Femur LISS Insertion Guide, right

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Assemble main component and radiolucent extension of the distal femur LISS insertion guide, left or right.



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## 2. Insert fixation bolt

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### Instrument

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324.043	Fixation Bolt
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Insert the fixation bolt through hole A of the distal femur LISS insertion guide by advancing the knurled nut on the fixation bolt fully against the knurled head of the bolt.

**Note: Letters (A–G) are used to identify the distal plate holes and numbers (1–13) are used to identify the diaphyseal plate holes.**

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### 3. Measure for screw length

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#### Instrument

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319.15*	Cannulated Screw Measuring Device
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Slide the tapered end of the cannulated screw measuring device over the guide wire, down to the bone. Read the scale at the end of the guide wire to determine appropriate screw length. This reading will place the screw 5 mm short of the tip of the guide wire, allowing the threaded portion of the guide wire to remain in the bone during screw insertion.

**Example: If the reading indicates 34 mm, use a 34 mm screw to place the screw 5 mm short of the wire tip.**

**Note: If countersinking, this should be done prior to measuring for screw length.**



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### 4. Screw fixation bolt to plate

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#### Instruments

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321.17	4.5 mm Pin Wrench
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324.043	Fixation Bolt
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Screw the fixation bolt into the LCP Distal Femur Plate using the top segment of the bolt. Final tightening is completed with a quarter turn of the 4.5 mm pin wrench.

\*Also available.

## 5. Screw nut

### Instruments

321.17	4.5 mm Pin Wrench
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324.043	Fixation Bolt
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Screw the nut on the fixation bolt toward the distal femur LISS insertion guide to stabilize the attachment between the guide and the LCP Distal Femur Plate. Final tightening is completed with a quarter turn of the 4.5 mm pin wrench.

## 6. Insert stabilization bolt

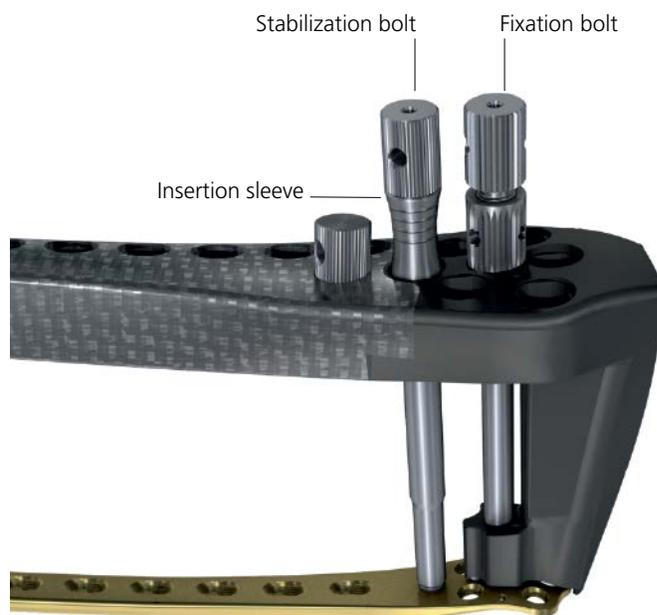
### Instruments

324.022	Insertion Sleeve
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324.043	Fixation Bolt
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324.044	Stabilization Bolt
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If desired, insert a stabilization bolt with insertion sleeve for 5.0 mm screws into an adjacent alpha (B–G) hole for a more stable attachment of the plate to the insertion guide. This offers greater stability if there is resistance from soft tissue or fracture fragments during insertion.

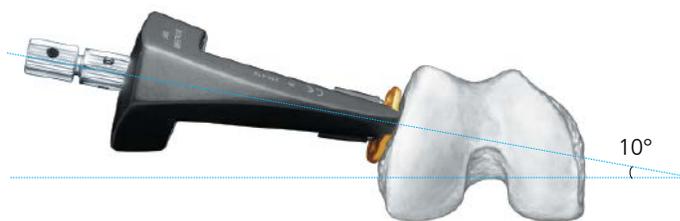


# Plate Insertion

## 1. Insert plate

Insert the plate between the vastus lateralis muscle and the periosteum. Keep the proximal end of the plate in constant contact with the bone during insertion. Place the distal end of the plate against the lateral condyle.

**Note: The distal femur LISS insertion guide may interfere with the soft tissues when using a 5-hole plate, or in large patients. In such cases, remove the proximal, radiolucent portion of the guide to aid insertion.**



## 2. Check plate orientation

Due to its weight, the distal femur LISS insertion guide has a tendency to tilt toward the floor (i.e., externally rotate). When the insertion guide is positioned properly on the lateral condyle, the insertion guide will be internally rotated approximately 10° to the femoral shaft.



# Plate Insertion

## 3. Adjust plate position if necessary

- To find proximal-distal plate placement, slide the plate proximally and then distally. Tactile feedback will indicate proper plate placement on the flange of the lateral condyle.

## 4. Insert K-wire through fixation bolt

### Instrument

292.699      2.0 mm Kirschner Wire

Insert a 2.0 mm Kirschner wire through the cannula of the fixation bolt to provide preliminary fixation of plate.

### Notes:

- A K-wire placed through the fixation bolt will be parallel to the joint in AP view when the fracture is reduced. Due to the type of fixation, if the wire is not parallel, the implant will not affect the existing reduction.
- A K-wire placed through hole E can be used to check the proximal-distal location of the plate in relation to the condylar notch.



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## 5. Confirm plate position

- Confirm proper position of the proximal end of plate with a lateral x-ray. The diaphyseal screws must be positioned through the center of the intramedullary canal; therefore the proximal end of the plate should be centered on the shaft in a lateral view.

### Alternative technique

Direct palpation through a slightly elongated proximal incision or probing with a K-wire can also be used to check plate location.

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## 6. Make incision at most proximal hole

### Instruments

324.022	Insertion Sleeve
324.027	5.0 mm Trocar

Once the plate has been inserted and positioned properly, with reduction reconfirmed, an incision is necessary at the most proximal plate hole. This location is marked using an insertion sleeve with 5.0 mm trocar in hole 5, 9, or 13. Make an incision at this location.



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## 7. Replace insertion sleeve and trocar

Through this stab incision, replace the insertion sleeve and trocar. Ensure that the insertion sleeve is fully seated in the guide to avoid interposed soft tissue, which can keep the bolt from engaging with the plate. Secure the sleeve by tightening the nut on the side of the guide.

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## 8. Remove trocar and tighten stabilization bolt

Remove the trocar and close the plate insertion frame by threading the stabilization bolt into the proximal plate hole. Final tightening of the stabilization bolt is completed with a quarter turn of the pin wrench.

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## 9. Insert K-wire through stabilization bolt

Insert a 2.0 mm K-wire through the cannula of the stabilization bolt. Check the position of the plate and reduction of the injured limb. Complete reduction and confirm plate position prior to placing initial screws.

**Note: If a supplementary stabilization bolt was inserted in a distal hole, it may now be removed.**



# Use of Pull Reduction Instrument

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## Instrument

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324.033	Pull Reduction Instrument
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Additional varus-valgus correction can be completed prior to placement of locking screws in both main fracture fragments. The pull reduction instrument with quick coupling is placed through the guide and plate holes to pull or push bone fragments in relation to the plate. This instrument can be used for:

- Minor varus-valgus adjustment (approximately 2°–4°)
- Translational adjustments
- Stabilization of plate-bone orientation during insertion of the first screws
- Alignment of segmental fragments
- Predrill dense or thick cortical bone before placing a 5.0 mm locking screw to prevent screw drilling flutes from filling before the screw is fully inserted. (For options in dealing with dense or thick cortices, see page 34.)

Three insertion sleeves are available in the set. The stabilization bolt must be used with an insertion sleeve, and one must be reserved for locking screw insertion. If more than one pull reduction instrument is used, insert the reduction instrument without the nut attached. The sleeve can be removed for use elsewhere, and the nut placed to tighten against the guide.

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## 1. Create stab incision

Place the insertion sleeve and trocar in the insertion guide. Mark the location with a skin impression. Remove the sleeve and trocar to create a stab incision.

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## 2. Reinsert sleeve with trocar

Reinsert the sleeve with trocar until it is fully seated, to ensure that no soft tissue is interposed. Remove the trocar.

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### 3. Insert pull reduction instrument through sleeve

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#### Instrument

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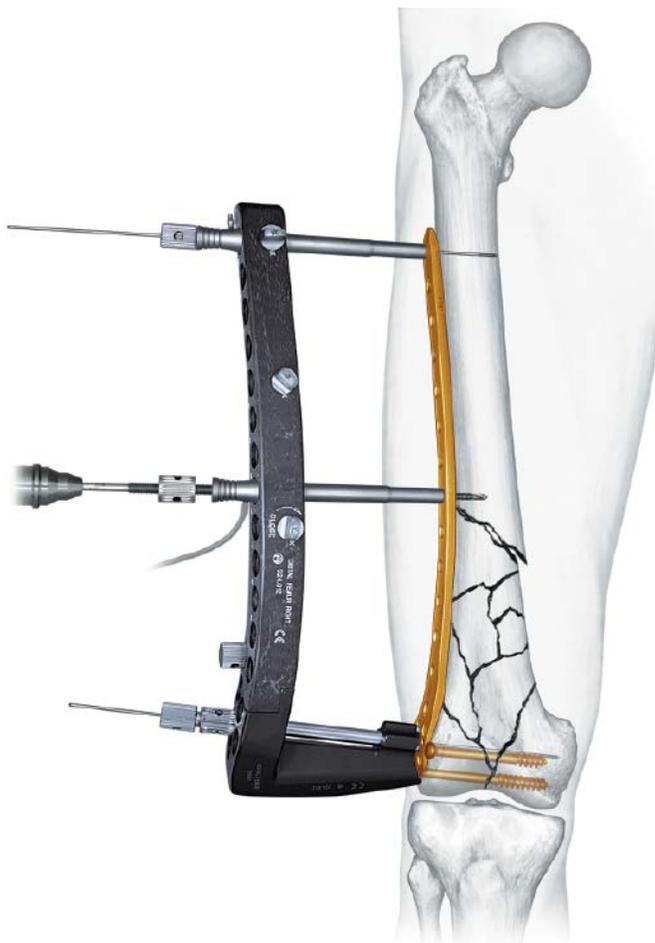
324.033	Pull Reduction Instrument
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When the pull reduction instrument has been attached to a power tool (quick coupling), place it in the desired position through the sleeve. (Use the irrigation method illustrated on page 33, "Irrigation and cooling").

With the nut in the highest position possible, begin power insertion of the pull reduction instrument. Stop insertion before the end of the threaded portion meets the plate surface. (Attempting to advance beyond this point may cause the threads to strip in the bone.)

**Precaution: It is important to monitor the advance of the screw tip carefully when inserting the pulling device. Stop the power tool before the pulling device is seated on the plate. Failure to do so may result in stripping the thread in the bone.**



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### 4. Remove power tool

- 1 Remove the power tool and begin tightening the nut toward the sleeve (or guide) while monitoring progress under C-arm imaging.

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## 5. Reduce fracture

Stop when the desired reduction is achieved. The pull reduction instrument is 4.0 mm in diameter to allow later placement of a 5.0 mm locking screw in the same hole.



# Insertion of Locking Screws

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Proper screw placement depends upon fracture type. Choose screw sites in accordance with biomechanical principles for external fixation: screws should be placed close to and away from the fracture. A minimum of four (4) screws is recommended in each main fracture fragment. (More screws may be appropriate in osteopenic bone.)

First, insert 5.0 mm titanium locking screws distally, recheck reduction, and then place proximal screws. As with conventional distal femur plate fixation, check to ensure that the initial locking screws in the condyles (B–G) are parallel to the joint as seen in AP view. After final fracture alignment is confirmed, proceed with inserting the remaining locking screws as planned.

**Note: In the case of thick or dense cortical bone, refer to page 34.**

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## 1. Make stab incision

Place the insertion sleeve and trocar into the insertion guide. Mark the location with a skin impression. Remove the sleeve and trocar to create a stab incision.

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## 2. Reinsert sleeve with trocar

Reinsert the sleeve with trocar, to ensure that no soft tissue is interposed between the locking screw and plate hole. Remove the trocar.

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### 3. Attach 5.0 mm locking screw

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#### Instrument

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324.050	3.5 mm Hexagonal Screwdriver Shaft, self-retaining
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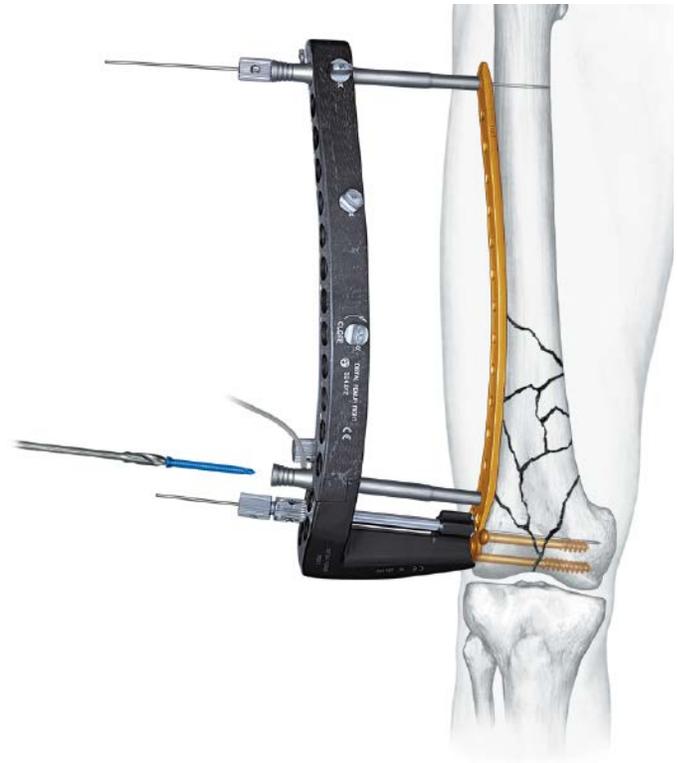
Attach a 5.0 mm locking screw to the 3.5 mm hexagonal screwdriver shaft until it snaps securely into place.

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### 4. Insert 5.0 mm locking screw

Insert a 5.0 mm locking screw with high-speed power and limited axial pressure. Use the irrigation method illustrated on page 33, "Irrigation and cooling."

**Warning: If the torque limiter is unavailable, do not tighten the screws to the plate under power. Perform final tightening by hand.**



The shoulder of the hexagonal screwdriver shaft indicates the distance of the screw head from the plate. Stop power insertion before the screw locks to the plate.



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## 5. Final tightening

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### Instruments

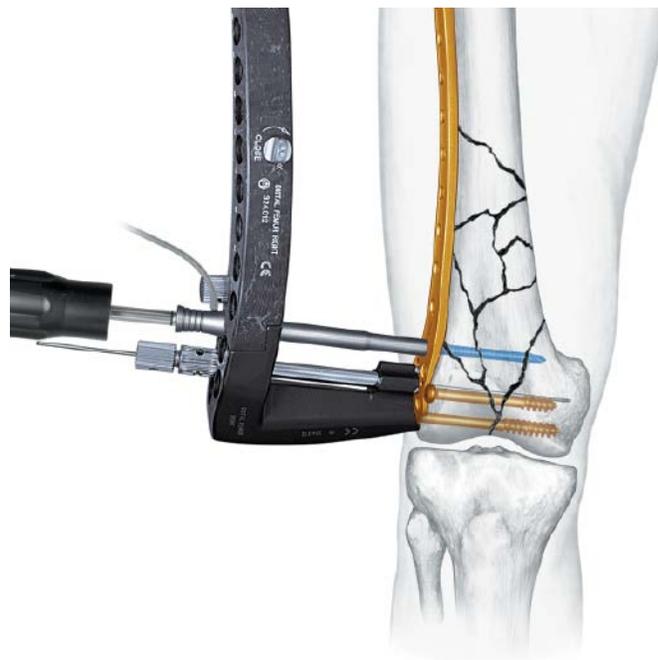
314.26*	Large Hexagonal Screwdriver, long
324.052	3.5 mm Torque Limiting Screwdriver

For final tightening, use the torque limiting screwdriver to ensure the torque applied reaches the minimum level necessary for locking. The screw heads should be flush with the plate surface.

**Note: In some instances, bone density or interposed soft tissue provides greater resistance to screw insertion than is normally expected. In order to ensure the screw head is flush with the plate and the screw is locked, additional tightening may be performed using the large hexagonal screwdriver.**

### Precautions:

- To reduce the risk of stripping the screw head do not lock the screws at full speed. This can make it difficult to remove the implants.
- For long screws and this cortical bone, ensure cooling during insertion.



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## 6. Insert diaphyseal screws

Place the diaphyseal screws so that the drill tip passes through the center of the intramedullary canal. (See page 33 for more information). It may be necessary to use the pull reduction instrument to maintain plate-bone distance (see page 20). In dense bone, drilling action of the initial screw will push the bone away from the plate.

**Note: If the screwdriver shaft is difficult to remove, see page 31.**

\*Also available.

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## 7. Use stoppers to mark screw locations

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### Instrument

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324.019      Stopper, for LISS Insertion Guides

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Mark each screw location in the guide, using a stopper for reference, as screw insertion proceeds as planned preoperatively.



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### Measuring for distal screw length

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#### Instruments

292.699	2.0 mm Kirschner Wire, 280 mm
324.037	2.0 mm Kirschner Wire Measuring Device
324.055	2.0 mm Kirschner Wire Insertion Sleeve

The chart in "Screw Selection," on page 11, will assist in selection of distal screw lengths (the alpha screws). Screw lengths may be confirmed using a 2.0 mm K-wire. The wire should be inserted through the 2.0 mm K-wire insertion sleeve and measured with the 2.0 mm K-wire direct measuring device. The wire is placed a minimum of 5 mm short of the medial cortex to ensure that the screw tip will not protrude.

**Precaution: When using periprosthetic screws never place a screw which is longer than the measured length, as this will result in stripping of the thread in the bone and loss of screw anchoring.**



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**Insertion of screws at locations of fixation or stabilization bolt**

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**Instrument**

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324.044	Stabilization Bolt
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If preoperative planning determined that the proximal end hole or hole A requires a locking screw, follow the instructions below. These steps ensure that the distal femur LISS insertion guide remains aligned with the LCP Distal Femur Plate for final screw insertion. When used, hole A must always be the last hole filled with a locking screw.

If a locking screw is not planned for hole A, it is recommended that a titanium screw hole insert be inserted. This ensures that the guide can be reattached for implant removal.

**Screw placed in most proximal hole**

- The stabilization bolt is used in the proximal hole to stabilize the insertion guide and plate. Removal of the stabilization bolt disrupts orientation with the remaining plate holes; therefore, this should be the last screw placed in the diaphysis.
- To insert the screw, remove the K-wire and then the stabilization bolt with the insertion sleeve remaining. Without applying pressure to the insertion guide, insert a 5.0 mm locking screw. (For 9- or 13-hole plates, the stabilization bolt and insertion sleeve may be placed in holes 5 and 9 to stabilize the frame, if these holes are free of screws.)

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**Screw placed in hole A (always inserted last)**

- The fixation bolt is the most important connection in stabilizing the insertion guide and plate. Once removed, it is difficult to reattach the guide to the plate and, therefore, orientation between the plate and guide is lost. As a result, insert this screw last.
- Before removing the fixation bolt, place stabilization bolts with insertion sleeves in two (2) adjacent, open holes (B–G). Remove the K-wire and fixation bolt. Place the insertion sleeve and then the locking screw.

It is also possible to insert this screw freehand, but only insertion through the handle ensures that the screw and plate are aligned, to provide a locked construct.

# Post-operative Treatment

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Post-operative treatment with LISS does not differ from conventional internal fixation procedures. Range of motion of the knee joint and partial weight bearing to at least 10 kg is appropriate. Restrictions may be appropriate in special cases. The presence of callus formation on x-ray indicates indirect or secondary bone healing.

## Implant removal

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### Instruments

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314.26*	Large Hexagonal Screwdriver
or	
314.75*	Hexagonal Screwdriver
324.052	3.5 mm Torque Limiting Screwdriver
324.053*	Cleaning Instrument

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Remove the implant only after complete consolidation of the fracture and remodeling of the medullary canal. Remove the implant in reverse order to implantation. First, make the incision to fit the insertion guide. Make stab incisions and use the 3.5 mm torque limiting screwdriver to remove the screws by hand. (A large hexagonal screwdriver can be used, but each lacks the self-retaining mechanism to aid in screw removal through a stab incision.) After explantation of all screws, remove the plate. If the plate is still not easily removed, detach the insertion guide and use only the fixation bolt. Loosen the plate by applying reciprocating movements to the fixation bolt.

**Note: Use the cleaning instrument, as necessary, to remove tissue from the hexagonal socket of the screw head to facilitate removal.**

\*Also available.

# Troubleshooting

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## Instruments

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314.26*	Large Hexagonal Screwdriver
or	
314.75*	Hexagonal Screwdriver
<hr/>	
324.052	3.5 mm Torque Limiting Screwdriver

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### **If the screw head is not flush with the plate level:**

- The screw may not be fully locked. Use the 3.5 mm torque limiting screwdriver, turning until it clicks.
- Soft tissue may be interposed between the plate and screw head. If the screw head is not flush after use of the 3.5 mm torque limiting screwdriver, use a large hexagonal screwdriver to complete tightening. To help avoid this problem, use the trocar prior to screw insertion.

### **If the power screwdriver jams in the screw head at insertion, the driver may be off center in the sleeve:**

- Release the quick coupling from the driver and loosen or remove the drill sleeve, or
- Back up the screw slightly and perform final tightening by hand with the torque limiting screwdriver, or
- If other options do not work, hold onto the chuck end with pliers to pull the screwdriver shaft out.

### **If the locking screw is difficult to insert or stops advancing prior to locking to the plate:**

- The screw should be removed and the flutes cleaned with a K-wire. The screw can be reused if its hexagonal socket is undamaged. This condition may be caused by unusually dense or thick cortical bone (see page 34).

\*Also available.

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## Reduction and fixation

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### Instrument

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324.033      Pull Reduction Instrument

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- To avoid interfering with placement of the LISS Plate on the lateral side, lag screws can be placed percutaneously from the medial side.
- If an extension table is used, careful traction should be applied to prevent the gastrocnemius muscle from pulling the distal fragment posteriorly or into hyperflexion. Posterior support of the distal fragment could facilitate reduction.
- Flexion-extension reduction of the distal fragment may be facilitated using a Schanz screw in the femoral condyle as a joystick. Insertion of a Schanz screw or the pull reduction instrument into the proximal fragment may also be helpful. Should it still be impossible to achieve fracture reduction, extend the incision to improve access.
- Bumps made of 8, 10, 12, or 15 towels can be used under the distal metaphyseal area to help reduce the fracture in the lateral view. These help to counteract the forces of the gastrocnemius. Small adjustments in these bumps can make marked changes in the reduction.
- Varus-valgus can be checked using the C-arm and a cautery cord from the femoral head to the center of the ankle joint on an AP view. Use the C-arm at the knee to check that the cord passes 10 mm medially to the center of the knee joint. Adjustment to varus-valgus reduction can be performed with the pull reduction instrument prior to locking screw placement in the malaligned fragment, or with manual pressure on the insertion guide opposed by pressure on the medial aspect of the distal femur.
- A distractor or large external fixator is a useful tool in gaining reduction. Proximal Schanz screw(s) should be placed anteriorly, and distal Schanz screws placed anteromedially and anterolaterally.
- Two distractors may also be used to gain reduction. One is applied medially and the second anterolaterally to minimize malreduction due to uneven distraction.
- Fractures not treated acutely should be placed in a spanning external fixator to maintain length until LISS fixation can be performed. This frame can also be used intraoperatively to assist in fracture reduction.
- For articular visualization, a Hohmann retractor can be used over the medial femoral condyle from a lateral incision. Flexion of the knee also offers visualization of a Hoffa fracture.

### Plate placement

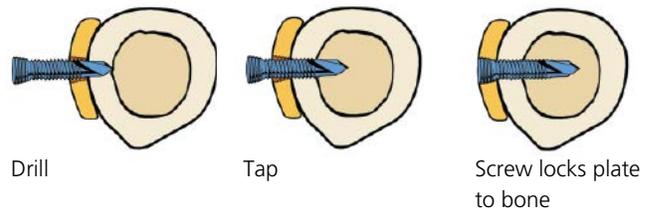
Should the plate be positioned too far anteriorly or posteriorly, the screws may not be centered on the bone. This position is not sufficient to ensure a stable fixation and can cause loss of fixation.

To ensure proper plate placement, these techniques may be used:

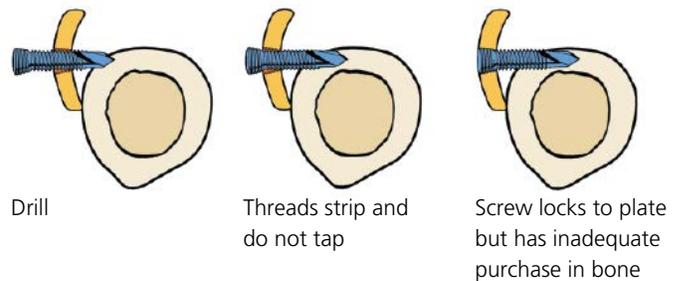
- Direct palpation through a slightly elongated incision for the stabilization bolt can be used to confirm the position of the proximal end of the plate.
- The insertion guide holes may be aligned with the plate holes under C-arm to confirm central location of the plate on the femoral shaft.

To check the position of the most distal screw, hole E, place a K-wire with the guide wire sleeve and check the position relative to the intercondylar notch.

#### Correct plate placement



#### Incorrect plate placement



### Irrigation and cooling

- The LISS insertion sleeve has a side port to allow irrigation. This is useful in cooling self-drilling locking screws or the pull reduction instrument during drilling. It is important to minimize thermal necrosis during the drilling step.
- Use standard IV tubing and a 60 cc syringe filled with sterile, physiologic saline solution. Attach the Luer lock to the syringe and cut the opposite end of the tubing. Slide the cut end of the tubing onto the port of the insertion sleeve.



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### **Screw insertion**

- Use power tools for screw insertion to ensure adequate performance of the self-drilling screw tip. The ease with which the screws advance into the bone will depend on several factors, such as bone density and power output of the tools. The screws should be advanced into the bone until the screw head locks in the plate.
- The screw's drilling tip has been dimensioned according to an average cortex thickness. If, during preoperative planning, it is determined that the cortex is 7 mm thick or more, predrill the cortex using the pull reduction instrument, which is 4.0 mm in diameter.
- If a standard locking screw is inserted and the drill tip flutes fill with bone chips, the screw will stop advancing. In this case, the screw should be removed and the flutes cleaned with a K-wire. The screw can be reused if its hexagonal socket is undamaged.
- Both the 3.5 mm hexagonal screwdriver shaft and the 3.5 mm torque limiting screwdriver are equipped with a self-retaining mechanism. Slight pressure should be used to ensure that the screwdriver shaft penetrates the socket of the screw head on pick-up. This retaining feature is key during a closed implant insertion.
- If necessary, bicortical 4.5 mm cortex screws may be used through the plate. These screws should be used prior to placement of any locking screws in that fracture fragment.

#### **Note: Heads will be prominent.**

- In the presence of a fracture around a prosthesis or IM nail, 4.5 mm cortex screws may be used, with the screws angled past the shaft of the prosthesis or nail.

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## Implant removal

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### Instrument

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324.053*	Cleaning Instrument
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If the cleaning instrument is employed during implant removal, it should be used through the insertion guide. Inspect the cleaning instrument after every use.

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## Plate contouring

The fixator's stability is not dependent on the plate matching the contour of the bone exactly, as in standard compression plating.

**Precaution: Bending and twisting of the LCP Distal Femur Plate is not recommended because it results in misalignment of the holes of the insertion guide and corresponding plate holes. This will make locking the screws to the plate difficult or impossible.**

\*Also available.

# Special Techniques

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## Temporary fixation with Kirschner wires

The system offers the ability to maintain central alignment of the plate on the femoral shaft while still allowing adjustment proximally or distally. This can be useful if length reduction adjustment is necessary after placement of locking screws in the distal femur, but before diaphyseal screws are placed.

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## 1. Insert K-wires to mark screw locations

### Instruments

324.034*	2.0 mm Kirschner Wire Centering Sleeve
324.048*	Kirschner Wire Aiming Attachment, for LISS

Place the K-wire aiming attachment into the desired hole in the insertion guide (holes 3 through 13 can be used). Insert 2.0 mm K-wire centering sleeves to mark locations.



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## 2. Make stab incision(s)

Remove the sleeves and make stab incision(s) at these locations. The stab incision must be large enough to accommodate adjustment in reduction.

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## 3. Reinsert sleeves and insert K-wires

Reinsert the sleeves and place K-wires in each. Note that the distance between the bone and the plate should be kept to a minimum because the wires converge as they are inserted. After insertion of K-wires, the distance between the plate and the bone can no longer be reduced.

\*Also available.

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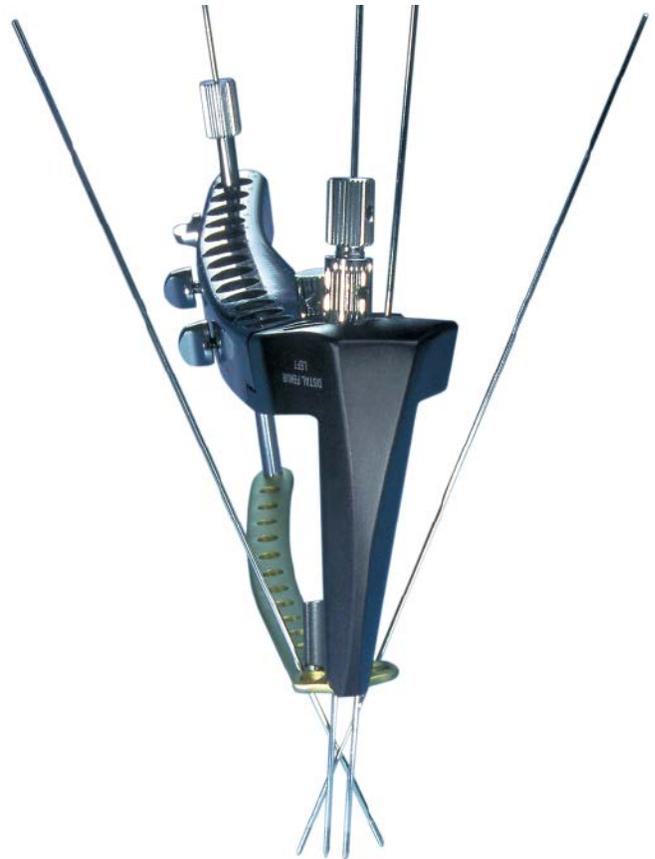
## 4. Remove sleeves

Remove the sleeves and then the aiming attachment.  
Additional length reduction may now be achieved.

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### Kirschner wire positioning

This photo shows K-wire positioning at the distal end of the plate. The lateral K-wires prevent the plate from migrating in the AP plane while still allowing for proximal/distal displacement and adjustment. When the correct position is determined, the plate can be temporarily locked with a K-wire through the fixation bolt.



# Implants

## Titanium LCP Distal Femur Plates, right<sup>o</sup>

	Holes	Length (mm)
422.250	5	156
422.252	7	196
422.254	9	236
422.256	11	276
422.258	13	316



## Titanium LCP Distal Femur Plates, left<sup>o</sup>

	Holes	Length (mm)
422.251	5	156
422.253	7	196
422.255	9	236
422.257	11	276
422.259	13	316

## 5.0 mm Titanium Locking Screws, self-drilling

	Length (mm)
422.391	18
422.392	26
422.393	40
422.394	55
422.395	65
422.396	75
422.397	85



## 5.0 mm Titanium Locking Screws, self-tapping

	Length (mm)
422.402*	14
422.404*	18



422.390 Titanium Screw Hole Insert, 5 mm



\*Also available.

# Instruments

292.699 2.0 mm Kirschner Wire, threaded spade point tip, 280 mm



321.17 4.5 mm Pin Wrench, 120 mm



324.011 Distal Femur LISS Insertion Guide, left



324.012 Distal Femur LISS Insertion Guide, right



324.019 Stopper, for LISS Insertion Guides, 5 mm



324.022 Insertion Sleeve, for 5.0 mm Titanium Locking Screws



324.027 5.0 mm Trocar, for use with Insertion Sleeve (324.022)



324.033 Pull Reduction Instrument, for LISS



324.037 2.0 mm Kirschner Wire Measuring Device, for LISS



324.043 Fixation Bolt, for LISS Insertion Guides



324.044 Stabilization Bolt, for LISS Insertion Guides



324.050 3.5 mm Hexagonal Screwdriver Shaft, self-retaining



324.052 3.5 mm Torque Limiting Screwdriver, self-retaining



324.055 2.0 mm Kirschner Wire Insertion Sleeve, for use with Insertion Sleeve (324.022)



# Ti LCP (LISS) Distal Femur Plate and Insertion Guide Set (145.473)

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## Graphic Case

690.368 LISS Distal Femur Graphic Case

## Instruments

324.011 Distal Femur LISS Insertion Guide, left  
324.012 Distal Femur LISS Insertion Guide, right  
324.019 Stopper, for LISS Insertion Guides, 5 mm, 20 ea.

## Implants

Titanium LCP Distal Femur Plates, right<sup>o</sup>

	Holes	Length (mm)
422.250	5	156
422.252	7	196
422.254	9	236
422.256	11	276
422.258	13	316

Titanium LCP Distal Femur Plates, left<sup>o</sup>

	Holes	Length (mm)
422.251	5	156
422.253	7	196
422.255	9	236
422.257	11	276
422.259	13	316

Note: For additional information, please refer to the package insert or [www.e-ifu.com](http://www.e-ifu.com).

For detailed cleaning and sterilization instructions, please refer to [www.depuyorthopedics.com/hcp/cleaning-sterilization](http://www.depuyorthopedics.com/hcp/cleaning-sterilization) or sterilization instructions, if provided in the instructions for use.

# LISS Instrument and 5.0 mm Titanium Locking Screw Set (145.471)

## Graphic Case

690.370 LISS Instrument Set Graphic Case

## Instruments

- 292.699 2.0 mm Kirschner Wire, threaded spade point tip, 280 mm, 10 ea.
- 321.17 4.5 mm Pin Wrench, 120 mm
- 324.022 Insertion Sleeve, for 5.0 mm Titanium Locking Screws, 3 ea.
- 324.027 5.0 mm Trocar, for use with Insertion Sleeve (324.022)
- 324.033 Pull Reduction Instrument, for LISS, 2 ea.
- 324.037 2.0 mm Kirschner Wire Measuring Device, for LISS
- 324.043 Fixation Bolt, for LISS Insertion Guides
- 324.044 Stabilization Bolt, for LISS Insertion Guides, 2 ea.
- 324.050 3.5 mm Hexagonal Screwdriver Shaft, self-retaining
- 324.052 3.5 mm Torque Limiting Screwdriver, self-retaining
- 324.055 2.0 mm Kirschner Wire Insertion Sleeve, for use with Insertion Sleeve (324.022)



## Implants

422.390 Titanium Screw Hole Insert, 5 mm, 5 ea.

5.0 mm Titanium Locking Screws, self-drilling  
Length (mm) Qty.

422.391	18	10
422.392	26	18
422.393	40	10
422.394	55	10
422.395	65	10
422.396	75	10
422.397	85	10

## Also Available

### Sets

01.120.335	LCP Distal Femur Plate Set
01.120.340	LCP Titanium Distal Femur Plate Set
01.120.338	Screw Rack Assembly with Self-Drilling Screws Set
01.120.341	Screw Rack Assembly with Self-Drilling Titanium Screws Set
01.120.339	LCP (LISS) Distal Femur Plate and Insertion Set–Stainless Steel

### Instruments

310.423	4.3 mm Drill Bit, quick coupling, 280 mm
314.26	Large Hexagonal Screwdriver, long
314.75	Hexagonal Screwdriver
314.163	StarDrive™ T25 Torque Limiting Screwdriver
319.15	Cannulated Screw Measuring Device
324.007	4.3 mm Drill Sleeve
324.034	2.0 mm Kirschner Wire Centering Sleeve
324.048	Kirschner Wire Aiming Attachment, for LISS
324.250	StarDrive Screwdriver Shaft, T25
324.053	Cleaning Instrument for 3.5 mm Hex, for 5.0 mm Locking Screws
324.253	Cleaning Instrument for T25 StarDrive, for 5.0 mm Locking Screws
324.056	X-Ray Calibrator, for Distal Femur LISS

### Implants

Stainless Steel LCP Distal Femur Plates, right <sup>◇</sup>		
	Holes	Length (mm)
222.250	5	156
222.252	7	196
222.254	9	236
222.256	11	276
222.258	13	316

Stainless Steel LCP Distal Femur Plates, left <sup>◇</sup>		
	Holes	Length (mm)
222.251	5	156
222.253	7	196
222.255	9	236
222.257	11	276
222.259	13	316

### LCP Distal Femur Plates, sterile

Stainless Steel	Titanium	Holes	Length (mm)	
02.124.030S	04.124.030S	15	356	right
02.124.031S	04.124.031S	15	356	left
02.124.034S	04.124.034S	17	396	right
02.124.035S	04.124.035S	17	396	left
02.124.038S	04.124.038S	19	436	right
02.124.039S	04.124.039S	19	436	left

### 5.0 mm Periprosthetic Locking Screws, self-tapping

Stainless Steel <sup>◇</sup>	Titanium	Length (mm)
02.221.458	—	8
02.221.460	—	10
02.221.462	—	12
222.402	422.402	14
222.404	422.404	18

### 5.0 mm StarDrive Periprosthetic Locking Screws, self-tapping<sup>◇</sup>

Stainless Steel	Titanium	Length (mm)
02.221.508	04.221.508	8
02.221.510	04.221.510	10
02.221.512	04.221.512	12
02.221.514	04.221.514	14
02.221.518	04.221.518	18

### 5.0 mm Locking Screws, self-drilling

Stainless Steel	Titanium	Length(mm)
213.418		18
213.426	413.426	26
213.440		40
213.455		55
213.465		65
213.475		75
213.485		85

<sup>◇</sup> Available nonsterile and sterile-packed.  
Add "S" to catalog number for sterile product.

# Discontinued Product

## Implants

### Titanium Distal Femur LISS Plates, right

	Holes	Length (mm)
422.340	5	156
422.344	9	236
422.348	13	316

### Titanium Distal Femur LISS Plates, left

	Holes	Length (mm)
422.341	5	156
422.345	9	236
422.349	13	316

### 5.0 mm Locking Screws, self-drilling

Stainless Steel	Titanium	Length(mm)
213.414	413.414	14
	413.418	18
213.422	413.422	22
213.430	413.430	30
213.435	413.435	35
	413.440	40
213.445	413.445	45
213.450	413.450	50
	413.455	55
213.460	413.460	60
	413.465	65
213.470	413.470	70
	413.475	75
213.480	413.480	80
	413.485	85
213.490	413.490	90

### 5.0 mm Locking Screws, self-drilling, with StarDrive Recess

Stainless Steel	Titanium	Length (mm)
212.251	412.251	14
212.252	412.252	18
212.253	412.253	22
212.254	412.254	26
212.255	412.255	30
212.256	412.256	35
212.257	412.257	40
212.258	412.258	45
212.259	412.259	50
212.260	412.260	55
212.261	412.261	60
212.262	412.262	65
212.263	412.263	70
212.264	412.264	75
212.265	412.265	80
212.266	412.266	85
212.267	412.267	90

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