

LCP Locking Compression Plate.

Combine without Compromise.


Instructions for Use



Original Instruments and Implants of the Association
for the Study of Internal Fixation – AO/ASIF

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-
-  Stardrive
 -  Hex drive
 -  Image intensifier

Warning

This description is not sufficient for immediate application of the instrumentation. Instruction by a surgeon experienced in handling these instruments is highly recommended.

LCP Locking Compression Plate.

Combine without Compromise.

LCP Locking Compression Plate

Angular stable support of fragments regardless of bone quality

Reduces the risk of primary and secondary loss of reduction even under high dynamic loading

Reduced impairment of periosteal blood supply due to limited plate-periosteum contact

Favorable hold also in osteoporotic bone and in multiple fragment fractures

Angular stable implant



- Stability of the implant regardless of bone quality; supply stability slightly dependent on bone quality
- Locking screws can be placed in each hole of the plate

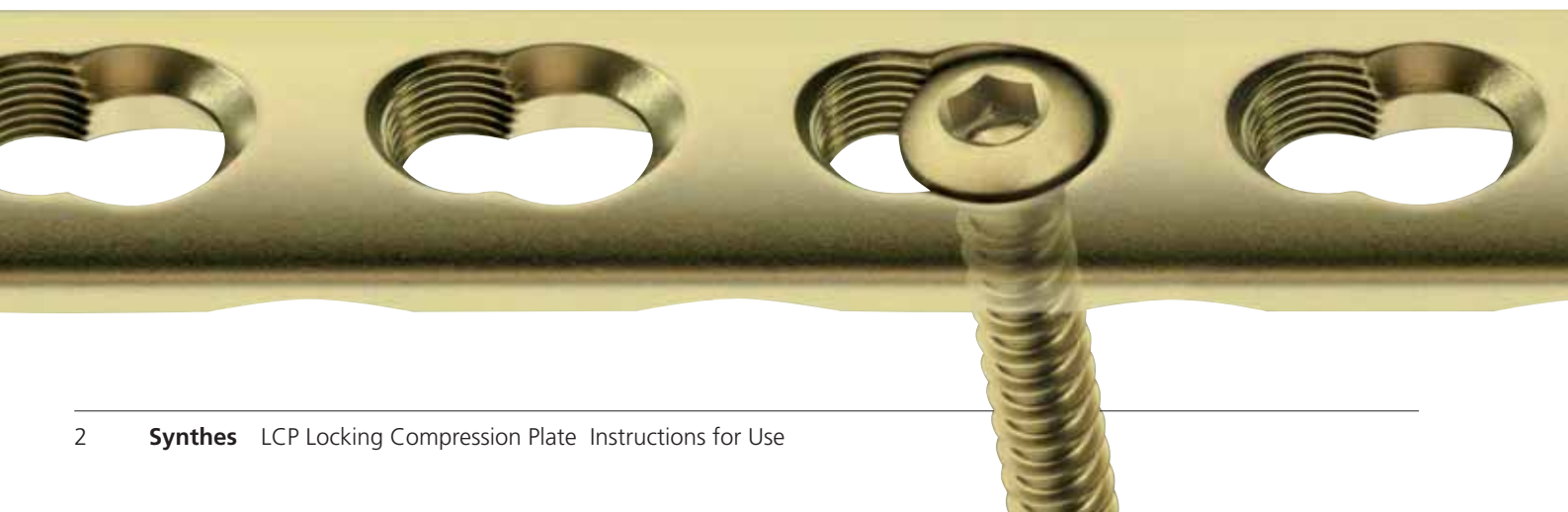


Because the screws are tightly locked in the plate:

- There is no tension on the bone
- Compression is eliminated between the plate and bone
- The periosteum is undamaged and circulation is retained

The plate does not have to be precisely shaped to the bone to provide stability. Minimally invasive surgery (MIS) is easy to perform:

- The soft tissue and the wound hematoma are treated gently
- Optimum circulation is maintained



Reduction maintained under a load

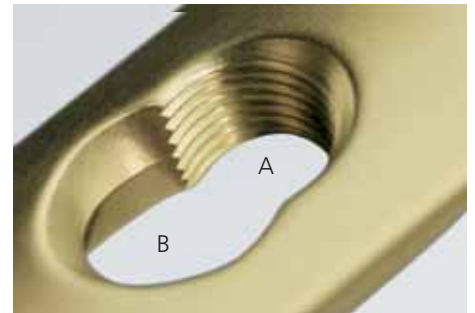


- Stable bridging of comminuted fractures
- The stable plate-screw connection decreases secondary loss of reduction in the epiphyseal and metaphyseal regions
- The screws are locked in the plate, and the physiological load (F) is transferred from the bone to the plate



- The fragments are fixed in their reduced position without regard to the plate model (internal fixator)
- The bone fragments are reliably fixed in the position assumed at the time the screws are locked

LCP combi-hole



A Stable plate-screw connection

- Locking screws reduce screw loosening
- Excessive torque is not applied to the cortical bone
- The conical screw head makes it easy to insert the screw

B Compatibility

- The proven dynamic compression hole allows you to use all standard screws

Self-tapping locking screws



- Use after precisely measuring the length (metaphysis)
- Monocortical or bicortical use
- Not necessary to separately tap thread

Self-drilling locking screws

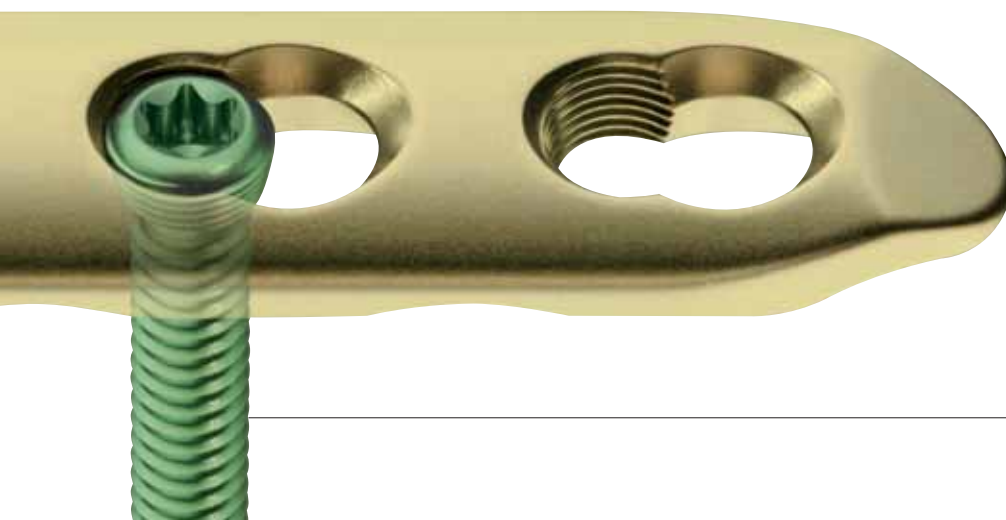


- Use without having to precisely measure the length (diaphysis)
- Only for monocortical use
- Tapping and predrilling are unnecessary

Standard screws



- Dynamic compression is created by the eccentric insertion of the standard screws (analogous to LC-DCP)



The aim of fracture operations is to reconstruct the anatomy and restore function. According to the Association for the Study of Internal Fixation (AO ASIF), the basic principles of osteosynthesis are anatomical reduction, stable fixation, maintenance of the blood supply, and early functional mobilisation.¹

Plate and screw osteosynthesis has been an established procedure for a long time and is clinically recognized. In the case of metaphyseal fractures and osteoporotic bone, the clinical results have been improved by the use of angular stable systems, or internal fixators.^{2,3}

The Locking Compression Plate (LCP) of the AO is based on the wealth of experience with standard plates and screws and the internal fixator. It enables the use of the standard plate technique, the internal fixator approach, and the specific combination of both methods. An indication can therefore be treated with the technique that achieves the best results without having to make compromises.

1 Rüedi T.P., Murphy W.M. et al. (2000) AO Principles of Fracture Management. Stuttgart / New York.

2 Tepic S., Perren SM (ed.) (1995). PC-Fix. Injury: Volume 26, Supplement 2.

3 Kregor P (ed.). (2001). LISS. Injury: Volume 32, Supplement 3.

Indications and Contraindications

Different types of small and large fragment plates with LCP combination holes are available. The existing designs of the Synthes small and large fragment plates (standard plates) have been retained. The same indications apply for LCP plates as for the corresponding standard plates.

In the case of metaphyseal fractures, comminuted fractures and osteoporotic bone, the clinical results can be improved by the angular stable screw/plate connection.

Because Synthes offers a wide variety of LCP plates, a correspondingly large variety of indications are covered. For this reason, this technical guide does not cover specific indications and the selection of the plate type. For a treatment of these subjects, please refer to "AO Principles of Fracture Management", courses offered by AO (www.aofoundation.org), and the corresponding professional literature.

The following techniques for handling the implants and instruments will be explained with reference to a straight 3.5 mm LCP plate. The handling method is the same for small and large fragment plates.

Standard Plate Technique

1

Reduce the fracture

- Reduce the fracture under the image intensifier. As needed, provide fixation with Kirschner wire or reducing forceps.

Alternative

Reduce the fracture indirectly using the plate by means of standard screws (for lag screw technique, see page 21).

2

Bend the plate

Required instruments

Small fragment

Bending Iron for Plates 2.4 to 3.5 (for use with 329.050)	329.040
Bending Iron for Plates 2.4 to 3.5 (for use with 329.040)	329.050
Bending Pliers for Plates 2.4 to 4.0	329.150
Bending Pliers for Reconstruction Plates 2.7 and 3.5	329.290

Large fragment

Bending Press	329.300
Bending Pliers for Plates 4.5	329.240
Bending Iron for LC-DCP 4.5 and DCP 4.5 (two required)	329.020
Bending Iron for Reconstruction Plates 3.5 and 4.5	329.080

Precisely contour the LCP plate to the anatomy using the appropriate bending instruments (as for standard plates), especially in the case of joint fractures.

Notes

- Do not bend back and forth.
- The LCP combi-holes are asymmetrical in the plate. In straight plates, the hole alignment changes in the middle of the plate. This asymmetry enables unidirectional dynamic compression to be exerted.



3

Position plate

Position the plate on the bone, and preliminarily fix it. If axial dynamic compression is used, make sure that the middle of the plate is above the fracture line.



4

Select the drill guide position

Required instruments

Small fragment

Universal Drill Guide	323.360
-----------------------	---------

Large fragment

Universal Drill Guide	323.460
-----------------------	---------

a. Select the neutral position

Press the spring-loaded guide against the bone in the DC part of the LCP hole. The inner sleeve retracts. The rounded end of the outer sleeve slides along the hole angle into neutral position. This enables neutral predrilling.



b. Select eccentric position (dynamic compression)

Place the universal drill guide on the edge of the DC part of the LCP hole without exerting any pressure. The inner sleeve remains in its original state. The dynamic compression is generated by setting and tightening the cortex screw.

Note: The LC-DCP drill guide (small fragment: 323.350; large fragment: 323.450) and the DC drill guide (small fragment: 323.320; large fragment: 322.440) are unsuitable for LCP plates.



5

Predrill screw hole

Required instruments

Small fragment

Drill Bit Ø 2.5 mm, for 3.5 mm Cortex Screw and 4.0 mm Cancellous Bone Screw	310.230
--	---------

Large fragment

Drill Bit Ø 3.2 mm, for 4.5 mm Cortex Screw and 6.5 mm Cancellous Bone Screw	310.290
--	---------

Predrill with an appropriate drill.

6

Determine screw length

Required instruments

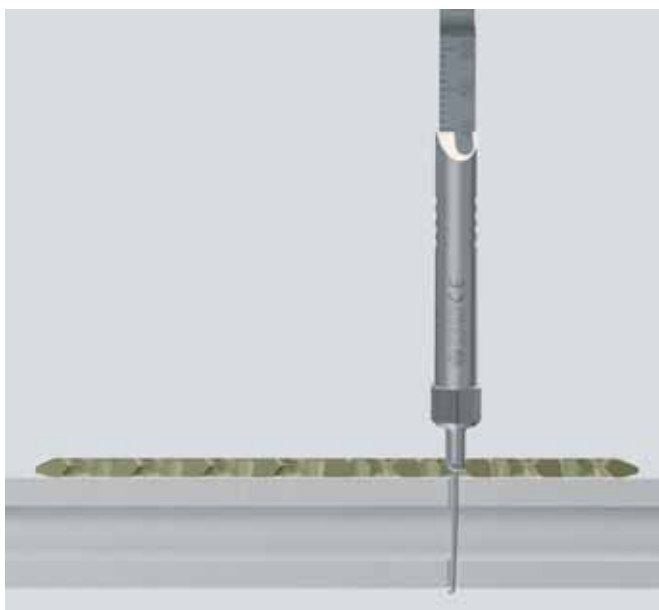
Small fragment

Depth Gauge	319.010
-------------	---------

Large fragment

Depth Gauge	319.100
-------------	---------

Measure the screw length with the depth gauge.



7

Option: Tap the thread

Required instruments

Small fragment

Tap for Cortex Screws Ø 3.5 mm	311.320
--------------------------------	---------

Large fragment

Tap for Cortex Screws Ø 4.5 mm	311.460
--------------------------------	---------

If self-tapping screws are not used, tap a thread manually.

8

Insert standard screw

Required instruments

T-Handle with Quick Coupling	311.440
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Small fragment

Screwdriver, hexagonal	314.070
------------------------	---------

Large fragment

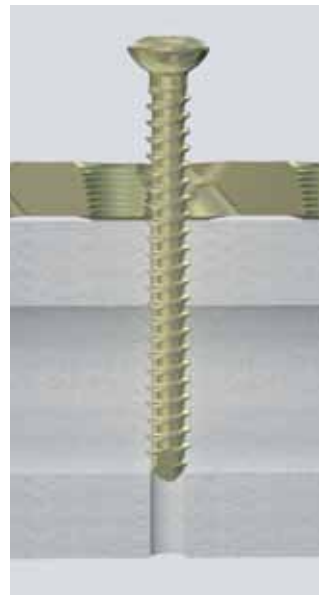
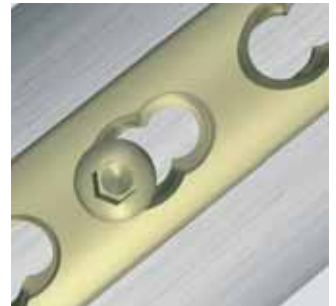
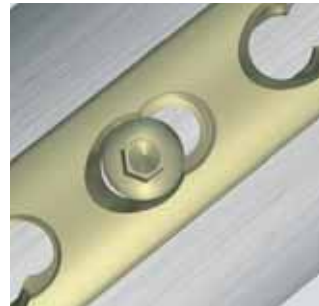
Screwdriver, hexagonal	314.270
------------------------	---------

Using the screwdriver, manually insert and tighten a standard screw with the measured length. Depending on the selected type of predrilling, no compression (a) or dynamic compression (b) may be generated.

Option: Insert a 2.7 mm cortex screw in a small fragment plate

Place an LCP washer 2.7/3.5 (X19.981) in the DC hole part of the 3.5 mm LCP plate. In this case, predrill with a drill bit with a 2.0 mm diameter (310.190).

Note: The holes in the straight LCP plates are larger at the two ends to allow the insertion of cancellous bone screws.



(a) no compression



(b) dynamic compression

Set Self-tapping Locking Screws

1

Reduce the fracture and preliminarily fix it

- Reduce the fracture under the image intensifier, and fix it with Kirschner wires or reducing forceps.

2

Bend the plate

Approximately adapt the plate to the anatomy using the appropriate bending instruments.

3

Position the plate and preliminarily fix it

Position the plate on the bone, and preliminarily fix it (for preliminary fixation using an LCP centering sleeve for Kirschner wires, see step 5).

Before setting the first locking screw, make sure that the plate is provisionally fixed well since it could otherwise rotate when locking the screw and damage soft tissue.

4

Set LCP drill sleeve

Required instruments

Small fragment

LCP Drill Sleeve	323.027
------------------	---------

Large fragment

LCP Drill Sleeve	323.042
------------------	---------

Carefully screw the LCP drill sleeve into the desired LCP hole until it is gripped completely by the thread. The LCP drill sleeve ensures that the locking screw is correctly locked in the plate. The angular stability is reduced if a locking screw is inserted obliquely.

Tip: To make it easier for the drill sleeve to grip the thread, it may be useful to slightly rotate it to the left (back).

Note: in the case of meta-epiphyseal plates, the threaded hole is usually not perpendicular to the plate surface due to the anatomy.



5

Option: Set Kirschner wire

Required instruments

Small fragment

Centering Sleeve for Kirschner Wires Ø 1,6 mm or	323.055
Centering Sleeve for Kirschner Wires Ø 1,25 mm	324.081

Large fragment

Centering Sleeve for Kirschner Wires Ø 2,0 mm	323.044
---	---------

Insert the centering sleeve for Kirschner wires into the LCP drill sleeve. To allow the locking screw alignment to be checked later, use a power tool to insert a Kirschner wire and check its position under the image intensifier. This check is especially recommendable in the metaphyseal region. Remove the Kirschner wire and the centering sleeve for Kirschner wires.

Note: If the angle of the locking screw is not optimal, it can be easily corrected. Bend the plate as needed, or move it in a proximal or distal direction. This technique is also suitable to preliminarily fix the plate to the bone.



6

Predrill screw hole

Required instruments

Small fragment

LCP Drill Bit Ø 2,8 mm	310.284
------------------------	---------

Large fragment

LCP Drill Bit Ø 4,3 mm	310.430
------------------------	---------

Carefully drill the screw hole using an appropriate drill.

Shove the stop ring down to the drill sleeve to make reading easier. Remove the drill sleeve.

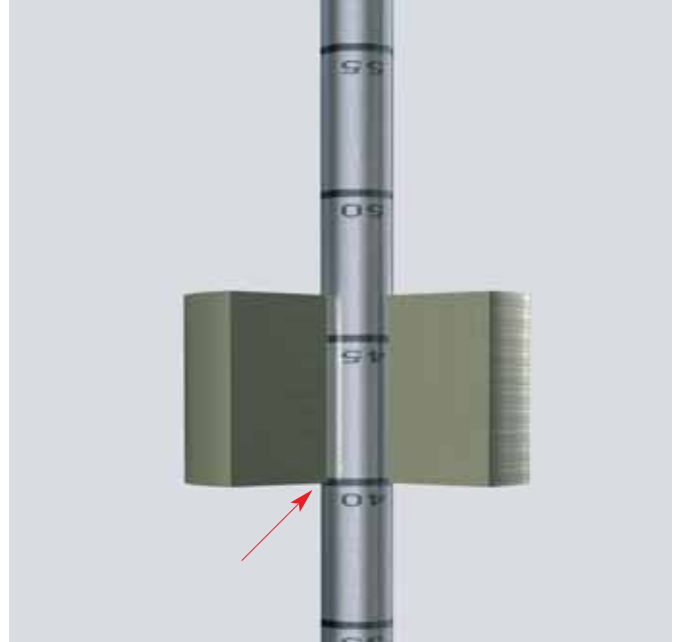
Note: Replacement stop rings can be ordered from the local Synthes representative.



7

Determine screw length

Read the drilled depth directly from the laser mark on the drill bit.



Alternative

Required instruments

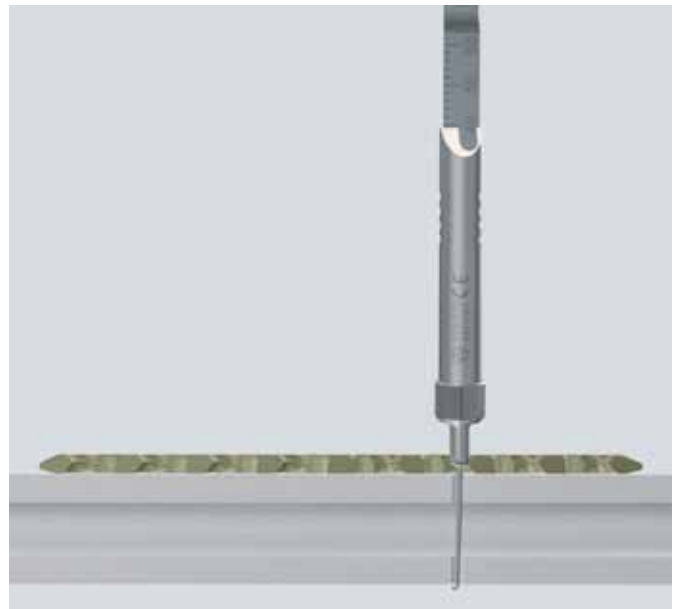
Small fragment

Depth Gauge	319.010
-------------	---------

Large fragment

Depth Gauge	319.100
-------------	---------

Determine the screw length with the depth gauge.



8

Insert locking screw

Required instruments

Small fragment

	Torque limiter, 1.5 Nm	511.770 or 511.115
★	<i>Stardrive</i> Screwdriver Shaft T15, self-holding	314.116
●	<i>Hexagonal</i> Screwdriver Shaft	314.030

Large fragment

	Torque limiter, 4.0 Nm	511.771
★	<i>Stardrive</i> Screwdriver Shaft T25, self-holding	314.119
●	<i>Hexagonal</i> Screwdriver Shaft or Screwdriver Shaft, self-holding or Torque-indicating Screwdriver, 4.0 Nm	314.150 314.152 324.052
	Handle for Torque Limiter Nos. 511.770 and 511.771	397.705
	Handle with Quick Coupling for 511.115	311.431
	Compact Air Drive	511.701
	Power Drive	530.100

Before setting the first locking screw, anatomical reconstruction must have occurred and, where necessary, fixed with lag screws. After setting the locking screws, additional reduction can no longer occur without removing the locking screws. The locking screws can either be inserted with a power tool without locking or manually.

a. Insertion with a power tool

To insert the locking screw using a power tool, fit a torque limiter to the power tool. Then insert the screwdriver shaft into the torque limiter.



Pick up the locking screw and insert it into the plate hole. To insert the screw, start the power tool slowly, increase the speed and then reduce it again before the screw is fully tightened. Uncouple the power tool, and mount the handle with the CAD coupling or the handle with the quick coupling, and manually tighten the screw. After one click, the optimum torque is reached.

Notes

- Do not lock the screws at full speed to reduce the risk of stripping the head. This can make it difficult to remove the implant.
- For long screws and thick cortical bone, ensure sufficient cooling during insertion.




The following table shows combinations of various drives and torque limiters, and the associated attachments:

Drive	Torque limiter (TLA)				
	Small fragment 511.770 (1.5 Nm)	Small fragment 511.773 (1.5 Nm)	Small fragment 511.115 (1.5 Nm)	Large fragment 511.771 (4.0 Nm)	Large fragment 511.774 (4.0 Nm)
Compact Air Drive	direct without attachment	attachment 511.750	attachment 511.750	direct without attachment	attachment 511.785
Power Drive	direct without attachment	attachment 511.750	attachment 511.750	direct without attachment	attachment 511.785
Colibri		attachment 532.013	attachment 532.013		attachment 532.017
Other power drives		AO/ASIF quick coupling	AO/ASIF quick coupling		AO/ASIF quick coupling for reamer
Handle for TLA	397.705	311.431	311.431	397.705	397.706
 Stardrive screwdriver shaft	314.116	314.116	314.116	314.119	314.119
 Hexagonal screwdriver shaft	314.030	314.030	314.030	314.150 314.152	314.150 314.152

b. Manual insertion

To insert the locking screw manually, attach the torque limiter handle to the torque limiter and insert a screwdriver shaft. Screw in the locking screw, and lock it in the plate.

-  Only for locking screws with a Hex drive (large fragment): Alternatively, the torque-indicating screwdriver can be used (324.052).



Set Self-drilling, Self-tapping Locking Screws

1

Preliminary fixation

Provisionally fix the LCP locking plate to the bone.



Note: The self-drilling screws are primarily inserted in bone regions where a precise determination of length is not required (diaphysis). They can only be set monocortically. Do not insert the drill tip into the opposite cortical bone since this can make removal difficult.

2



Set locking screw

Required instruments

Small fragment

	Torque limiter, 1.5 Nm	511.770 or 511.115
	<i>Stardrive</i> Screwdriver shaft T15, self-holding	314.116
	<i>Hexagonal</i> Screwdriver shaft	314.030

Large fragment

	Torque limiter, 4.0 Nm	511.771 or 511.774
	<i>Stardrive</i> Screwdriver Shaft T25, self-holding	314.119
	<i>Hexagonal</i> Screwdriver shaft or Screwdriver shaft, self-holding	314.150 314.152
	Handle with Quick Coupling	397.705
	Compact Air Drive II	511.701
	Power Drive	530.100

For additional combinations, see the table on page 14.

Insert a self-drilling locking screw of the desired length using a power tool with the torque limiting attachment and the screwdriver shaft along the thread axis of the hole and screw it in. Stop the power tool before the screw is locked. Remove the power tool and mount the handle. Lock the screw and tighten it until a click can be heard.

Notes

- Especially when the cortical bone is thick and the locking screw is set perpendicular, predrilling with the LCP universal drill guide (small fragment: 323.505; large fragment: 323.500) is recommended. The universal drill guide is also used when inserting self-tapping screws in the diaphyseal region. For further information, see page 18.
- You can alternatively follow steps 4-7 on pages 10–12.
- Cooling is recommended for longer screws.

Indirect Reduction with Locking Screws

1

Shove the screw holding sleeve over the torque-indicating screwdriver

Required instruments

Small fragment

Holding Sleeve for Screws, for LCP 314.091

Stardrive Screwdriver T15 314.041

Hexagonal Screwdriver 314.070

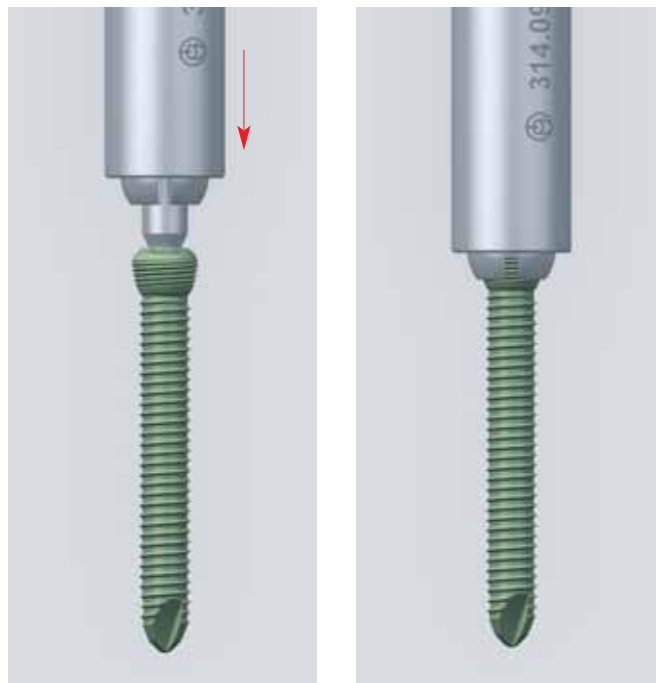
Large fragment

Holding Sleeve for Screws, for LCP 314.281

Stardrive Screwdriver T25 314.164

Hexagonal Screwdriver 314.270 oder 324.052

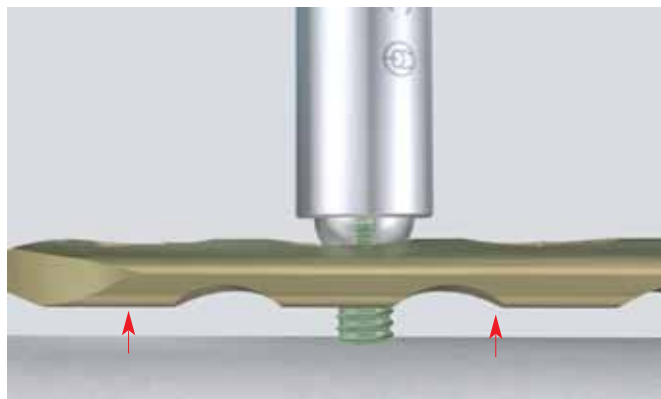
Mount the screw holding sleeve on the screwdriver. Hold the locking screw by placing the screw holding sleeve over the head of the screw.



2

Insert screw

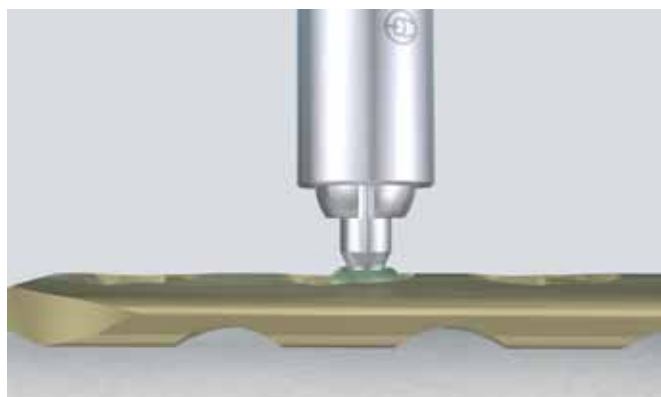
Insert the screw. The screw holding sleeve prevents the screw from locking in the plate. As soon as the screw holding sleeve reaches the plate, the bone is approached by continuing to screw the screw in the plate.



3

Retract the screw holding sleeve

After the desired reduction is attained, retract the screw holding sleeve from the head of the locking screw.



4

Lock the screw

Required instruments

Small fragment

	Torque limiter, 1.5 Nm	511.770
★	<i>Stardrive</i> Screwdriver Shaft T15, self-holding	314.116
●	<i>Hexagonal</i> Screwdriver Shaft	314.030

Large fragment

	Torque limiter, 4.0 Nm	511.771
★	<i>Stardrive</i> Screwdriver Shaft T25	314.119
●	<i>Hexagonal</i> Screwdriver Shaft or Screwdriver Shaft, self-holding or Torque-indicating Screwdriver	314.150 314.152 324.052
	Handle for Torque Limiter	397.705


For additional combinations, see the table on page 14.

Remove the screwdriver and holding sleeve. Place the torque limiter handle on the torque limiter, and insert a screwdriver shaft. Screw in the locking screw, and lock it in the plate.

- Only for locking screws with a Hex drive (large fragment):
Alternatively, the torque-indicating screwdriver can be used.

Note: This technique is only suitable for pulling the bone to the plate. To generate interfragmentary compression, use cancellous bone or cortical bone screws (lag screw principle).

Predrilling with the LCP Universal Drill Guide

 The LCP universal drill guide is only available with a Hex drive.

Required instruments	
Small fragments	
LCP Universal Drill Guide 3.5	323.505
Hexagonal Screwdriver Shaft	314.030
Large fragments	
LCP Universal Drill Guide 4.5/5.0	323.500
Hexagonal Screwdriver Shaft, or	314.150
Screwdriver Shaft, hexagonal, self-holding	314.152

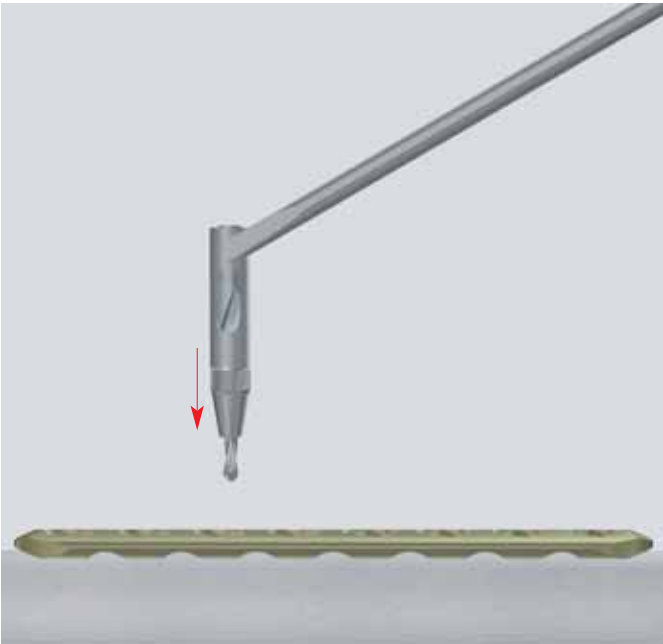
The LCP universal drill guide can alternatively be used for predrilling. The universal drill guide has a drill guide on one side that enables centric and eccentric predrilling; a short drill bit is on the other side (small fragments Ø 2.8 mm; large fragments Ø 4.3 mm).



1

Set the LCP universal drill guide

Insert the universal drill guide into the threaded part of the LCP hole.



2

Drill through the cortical bone

Use a power tool to drill through the proximal cortical bone with the screwdriver shaft in the drill guide.



3

Remove the LCP universal drill guide





Remove the drill guide.

4

Set locking screw

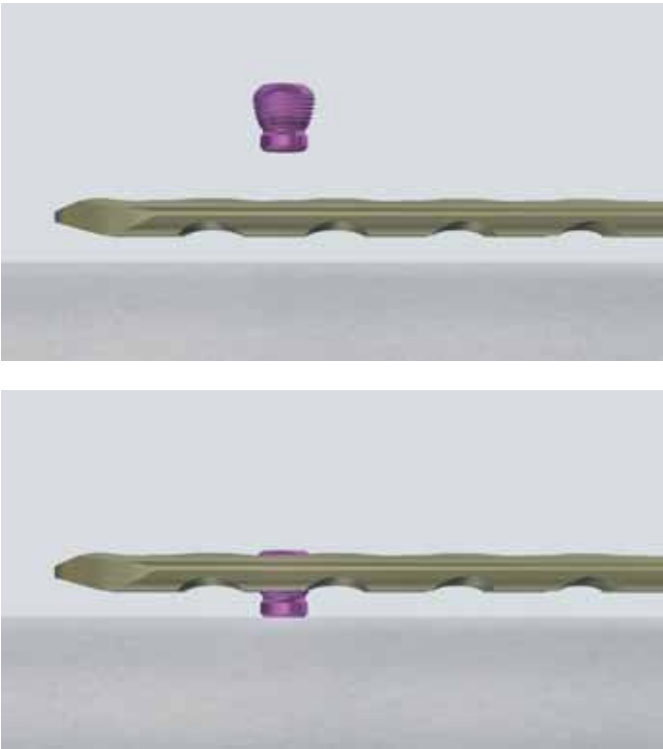
Set the self-drilling, self-tapping locking screw as described on page 15.

Set LCP Spacers

Required instruments		
	Steel	Titanium
Small fragment		
 Spacer Ø 3.5 mm	222.476	422.476
 Spacer Ø 3.5 mm	213.009	413.009
Large fragment		
 Spacer Ø 5.0 mm	222.477	422.477
 Spacer Ø 5.0 mm	213.309	413.309

To reduce the plate-to-bone contact to a minimum, screw an LCP spacer in the plate before positioning the plate. The spacer ensures that a distance of 2 mm will be maintained between the plate and the bone when the screws are later inserted.

The spacer can be removed after setting the locking screws.

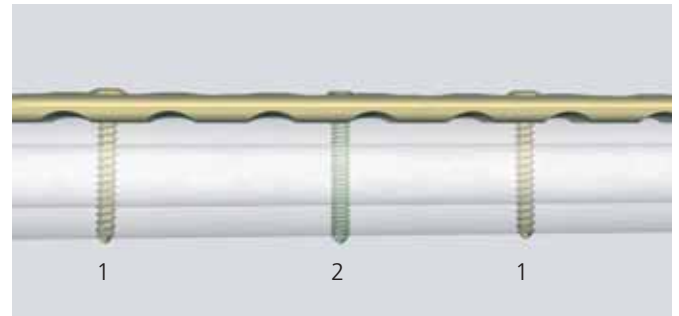


Examples of the Combination Technique

Standard screws and angular-stable locking screws can be easily combined.

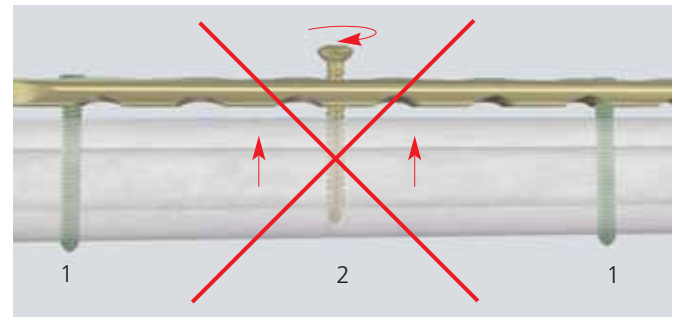
Example A

If a plate is first fixed with standard screws (1), locking screws can be introduced later (2) to fix the fragments at a stable angle.



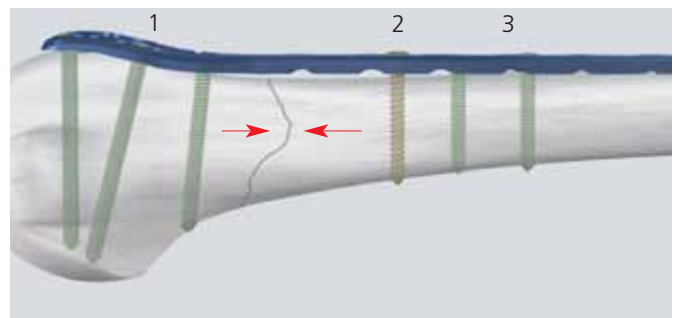
Example B

If a plate is first fixed to a fragment with locking screws (1), it is not recommendable to later insert standard screws in the same fragment (2). In this case, the locking screws must be removed first before inserting the standard screws.



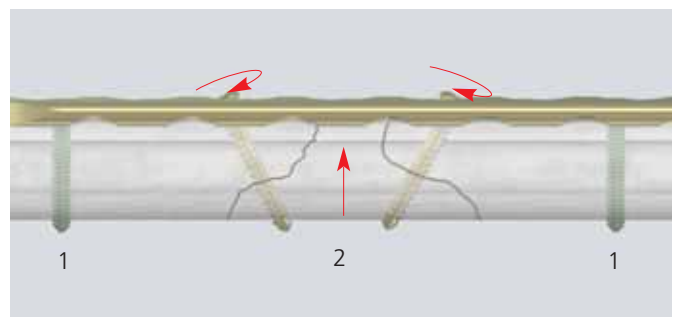
Example C

If the metaphyseal fragment is fixed with locking screws (1), the fracture can be dynamically compressed with standard screws (2). To increase the stability of fixation, insert additional locking screws into the diaphyseal fragment (3).



Example D

In the case of a diaphyseal fracture, standard screws can be alternately inserted as lag screws after the locking screws have been inserted (1) to draw the opposing fragments to the plate (2).



Remove the Implant

To remove the plate, first remove the tissue and bone from all screw heads and drives. Insert a screwdriver that is in good condition in the screw recess and unlock all screws manually. In a second step, completely remove all the screws.

If the screws cannot be removed with the screwdriver, set the conical extraction screw with the left-hand thread (small fragment: 309.521; large fragment: 309.530) in the screw head using the T-handle with Quick Coupling (311.440), and remove the locking screw counter-clockwise.

If the conical extraction screw does not grip or the screw cannot be removed, proceed as follows:

Remove the screw head from the shaft with the drill bit for metal (small fragment: drill bit Ø 3.5 mm, Art. No. 309.504S; large fragment: drill bit Ø 4.8 mm, Art. No. 309.506S). The screw shaft can be removed with the screw extraction set.

Note: The drill bit for metal is used when the conical extraction screw cannot be anchored in the screw head. The drill bit for metal is delivered sterile and is only suitable for single use. It cannot be reused.



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