Small Fragment Locking Compression Plate (LCP) System

Stainless Steel and Titanium

Surgical technique

LOC Plate series

WASTON MEDICAL 华森

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Introduction

AO Principles
In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation. These principles, as applied to the Small Fragment LCP implants, are:

Anatomic reduction
Facilitating restoration of the articular surface by exact screw placement with wire sleeves

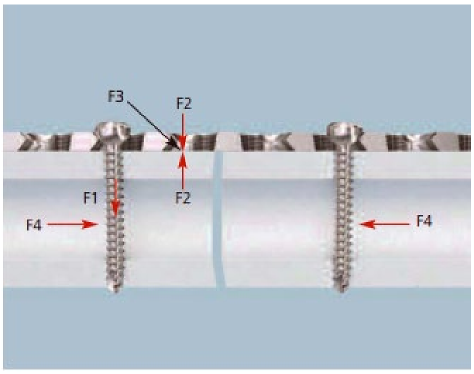
Stable fixation
Locking screws create a fixed-angle construct, providing angular stability.

Preservation of blood supply
Tapered end allows submuscular plate insertion, preserving tissue viability.
Limited-contact plate design reduces plate-to-bone contact, limiting vascular trauma and insult to bone.

Early, active mobilization
Plate features combined with AO technique create an environment for bone healing, expending a return to optimal function.

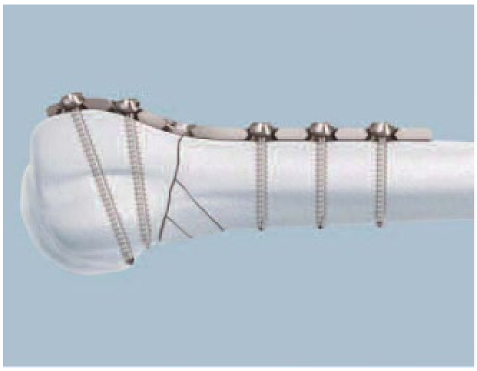
Fixation Principle
The locking screw concept was produced by Dr.Tepic S and Dr.Perren SM for the first time in 1995. With locking compression plate put in use, it has become one of the most important developments of plate and screw internal fixation in recent years. Locking screws provide the ability to create a fixed-angle construct while utilizing familiar conventional plating techniques. The fixed-angle construct function like a internal fixator which maintain primary and secondary loss of reduction. This kind of construct also provides improved fixation in osteoporotic bone or multifragment fractures where traditional screw is compromised. LCP constructs do not rely on plate-to-bone compression to maintain stability. Therefore, the periosteum will be protected and the blood supply to the bone preserved. With these distinguished improvements, the LCP become an important category of increasing importance for trauma treatment.

Product Information
Conventional plating
<u>Absolute stability</u>



The tensile force (F1) originating from tightening the screws presses the plate onto the bone (F2). The developing friction (F3) between the plate and the bone leads to stable plate fixation. To ensure absolute stability, the friction resistance must be higher than the axial forces (F4) arising during rehabilitation.

Anatomic contouring of the plate



The aim of internal fixation is anatomic reduction, particularly in articular fractures. Therefore, the plate must be contoured to the shape of the bone.

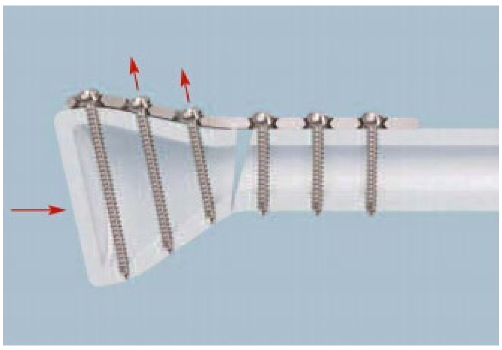
Lag screw

Interfragmentary compression is accomplished by using a lag screw. This is particularly important in intra-articular fractures which require a precise reduction of the joint surfaces. Lag screws can be angled in the plate hole, allowing placement of the screw perpendicular to the fracture line.

Primary loss of reduction

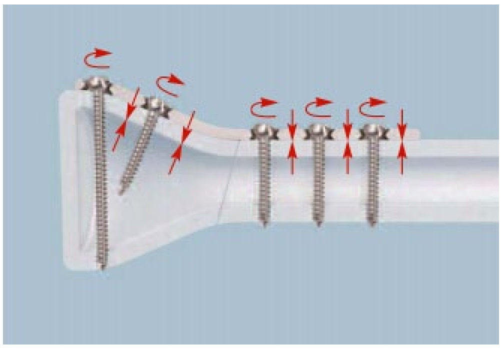
In conventional plating, even though the bone fragments are correctly reduced prior to plate application, fracture dislocation will result if the plate does not fit the bone. In addition, if the lag screw is not seated perpendicular to the fracture line (e.g., spiral fracture of the distal tibial), shear forces will be introduced. These forces may cause loss of reduction.

Secondary loss of reduction



Under axial load, postoperative, secondary loss of reduction may occur by toggling of the screws. Since cortex screws do not lock to the plate, the screws cannot oppose the acting force and may loosen, or be pushed axially through the plate holes.

Blood supply to the bone



The periosteum is compressed under the plate area, reducing or even interrupting blood supply to the bone. The result is delayed bone healing due to temporary osteoporosis underneath the plate.

Osteoporosis

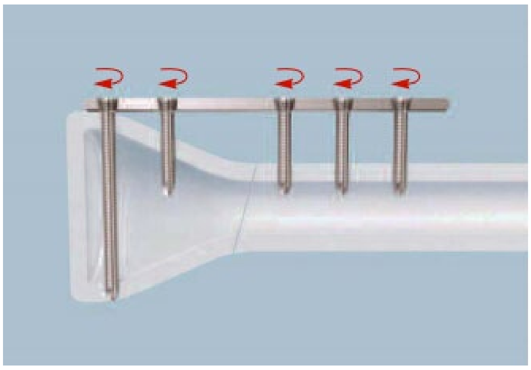
Due to compromised cortical structure, screws cannot be tightened sufficiently to obtain the compression needed to support the bone. This may cause loosening of the screws and loss of stability, and may jeopardize the reduction.

Standard plating achieves good results in:
-Good quality bone
-Fractures which are traditionally fixed with lag screws to achieve direct bone healing

Special attention must be paid to:
-Osteoporotic bone; during rehabilitation, the load should be kept to a minimum to prevent postoperative loss of reduction
-Multifragmentary fractures; the anatomic reduction may be accomplished at the expense of extensive soft tissue and denudation

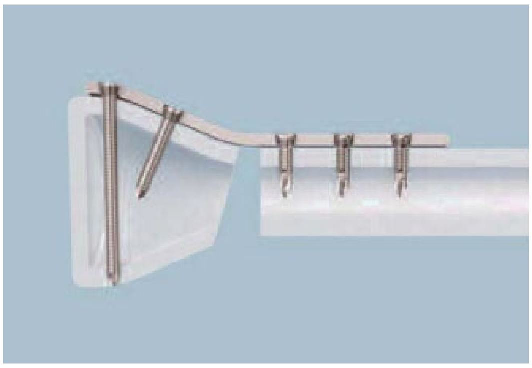
Bridge/locked plating using locking screws
-Screws lock to the plate, forming a fixed-angle construct
-Bone healing is achieved indirectly by callus formation when using locking screws exclusively.

Maintenance of primary reduction



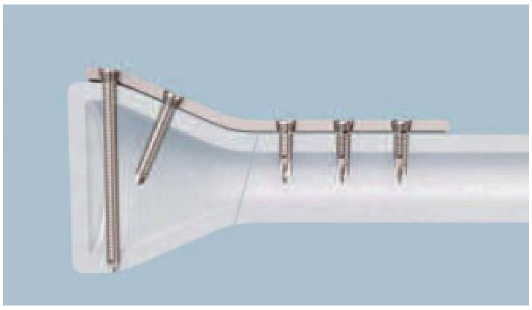
Once the locking screws engage the plate, no further tightening is possible. Therefore, the implant locks the bone segments in their relative positions regardless of degree of reduction.
Pre-contouring the plate minimizes the gap between the plate and the bone, but an exact fit is not necessary for implant stability. This feature is especially advantageous in minimally or less invasive plating techniques because these techniques do not allow exact contouring of the plate to the bone surface.

Stability under load



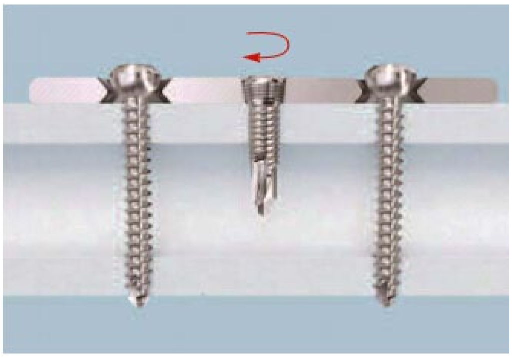
By locking the screws to the plate, the axial force is transmitted over the length of the plate. The risk of a secondary loss of the intra-operative reduction is reduced.

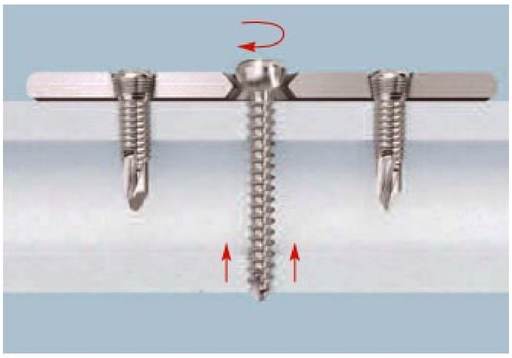
Blood supply to the bone

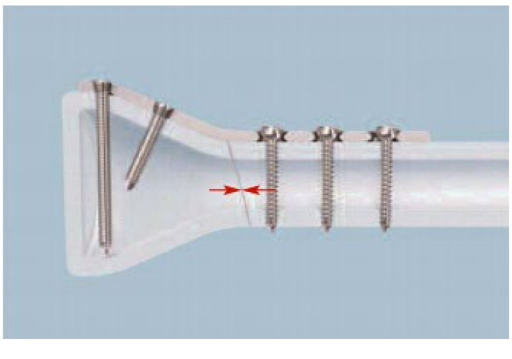


Locking the screw into the plate does not generate additional compression. Therefore, the periosteum will be protected and the blood supply to the bone preserved.

Combined internal fixation







The combination of conventional compression plating and locked plating techniques enhances plate osteosynthesis. The result is a combination hole of Combi hole that, depending on the indication, allows standard compression plating, locked/bridge plating or a combination of both.

Internal fixation using a combination of locking screws and standard screws

Note: if a combination of cortex and locking screws is used, a cortex screw should be inserted first to pull the plate to the bone.

If locking screws (1) have been used to fix a plate to a fragment, subsequent insertion of a standard screw (2) in the same fragment without loosening and retightening the locking screw is not recommended.

Note: if a locking screw is used first, care should be taken to ensure that the plate is held securely to the bone to avoid spinning of the plate about the bone.

Dynamic compression

Once the metaphyseal fragment has been fixed with locking screws, the fracture can be dynamically compressed using standard screws in the DCU portion of the Combi hole.

Locked and standard plating techniques

-First, use lag screws to anatomically reconstruct the joint surfaces.

-The behavior of a locking screw is not the same as that of a lag screw. With the locked plating technique, the implant locks the bone segments in their relative positions regardless of how they are reduced

-A plate used as a locked/bridge plate does produce any additional compression between the plate and the bone.

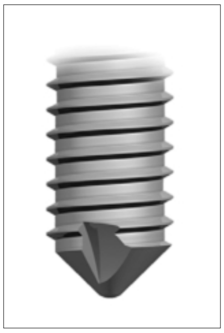
-The unicortical insertion of a locking screw causes no loss of stability.

Small Fragment Locking Compression Plate (LCP) System

Locking screw features

Locking screw with hex drive recess

The hex drive recess provides improved torque transmission to the screw and minimizes the possibility of cross thread.



Locking screw with self-tapping flutes

Less surgical steps

Cortical thread with large core diameter

The large core diameter improves bending and shears strength of the screw, and distributes the load over a larger area in the bone.

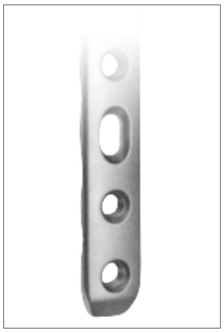
Special double-lead thread beneath the screw head engages and locks into the threaded holes of the plate.

Easier and faster locking the screws with the plates

Locking screw features

The unique locking hole design

The locking holes allow placement of conventional cortex and cancellous bone screws of locking screws on the same hole.



Round holes

The round holes allow placement of conventional cortex and cancellous bone screws on the side or threaded conical locking screws on the opposite side of each hole.

Periarticular plates anatomical design

Periaticular plates are pre-contoured to create an anatomical fit that requires little or no additional bending and minimizes impinging on the soft tissue.

Indications

The LCP system applies to many different plate types and is therefore suitable for a large number of fracture types.

Fractures

Osteotomies

Malunions, nonunions

Surgical Technique

Plate selection

The plates are available in various lengths. If necessary, use a bending template to determine plate length and configuration.

Contouring

Use the current bending instruments to contour the locking compression plate to the anatomy. The plate holes have been designed to accept some degree of deformation. When bending the plate, place the bending irons on two consecutive holes. This ensures that the threaded holes will not be distorted. Significant distortion of the locking holes will reduce locking effectiveness.

Reduction and temporary plate placement

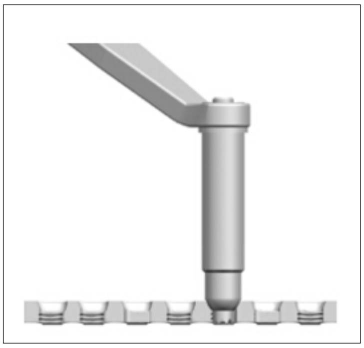
The plate may be temporarily held in place with standard plate holding forceps. The middle of the plate should be positioned over the fracture site if compression of the fracture fragments is desired. Alternatively, the Drill Guide can be used as an aid to position the plate on the bone.

Screw insertion

Determine whether conventional cortex screws, cancellous bone screws or locking screws will be used for fixation. A combination of all may be used. If a combination of cortex, cancellous and locking screws is used, a conventional screw should be used first to pull the plate to the bone. If a locking screw is used first, care should be taken to ensure that the plate is held securely to the bone to avoid spinning of the plate about the bone as the locking screw is tightened to the plate.

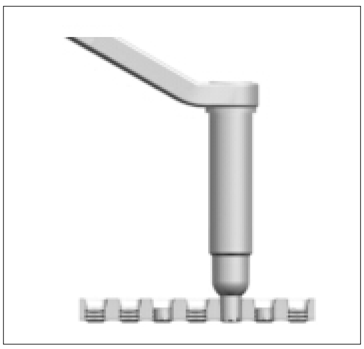
Neutral insertion of a screw in compression holes and locking holes

When pressing the universal drill guide or special locking drill guide into the DCU portion of the compression holes, it will center itself and allow neutral pre-drilling.



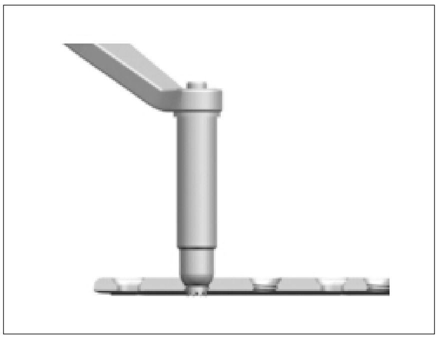
Dynamic compression, eccentric insertion of a cortex screw in compression hole

To drill a hole for dynamic compression, place the universal drill guide eccentrically at the edge of the DCU portion of the compression hole, without applying pressure. Tightening of the cortex screws will result in dynamic compression corresponding to that of LC-DCP plates.



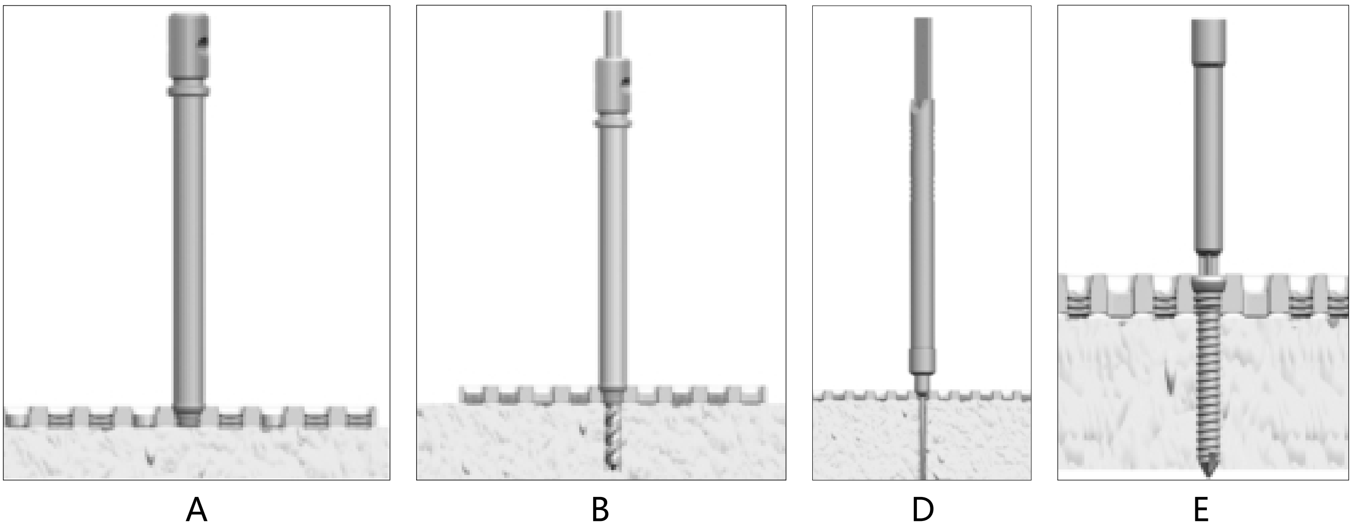
Neutral insertion of a conventional screw in locking hole

When pressing the universal drill guide into the unique design locking hole, it will center itself and neutral pre-drilling.



Insertion of the locking screws

The locking screw is not a lag screw. Use non-locking screws when requiring a precise anatomical reduction (e. g. joint surfaces) or interfragmentary compression. Before inserting the first locking screw, perform anatomical reduction and fix the fracture with lag screws, if necessary. After the insertion of locking screws, an anatomical reduction will no longer be possible without loosening the locking screw.



A. Screw the appropriate Threaded Drill Guide for 3.5 mm, 5.0mm screws into an LCP plate hole until fully seated. Do not try to bend the plate using the Threaded Drill Guide because damage may occur to the threads.

B. Use the appropriate Drill Bit (2.8mm for 3.5mm screws, 4.3mm for 5.0mm screws) to drill to the desired depth.

C. Remove the drill guide.

D.Use the Depth Gauge to determine screw length.

E.Insert the locking screw and finally tighten using the Torque Limiting Screwdriver. The screw is securely locked to the plate when a “click” is heared. Never use power equipment to seat the locking screws into the plate without a Torque Limiting Screwdriver

Postoperative treatment

Postoperative treatment with locking compression plates does not differ from conventional internal fixation procedures.

Implant removal

To remove locking plates, unlock all screws from the plate; then the screws completely from the bone. This prevents simultaneous rotation of the plate when removing the last locking screw.

Implants

10701
Ulna & radius LOC plate

Product No.	Holes	Length(mm)
10701-005	5	69
10701-006	6	82
10701-007	7	95
10701-008	8	108
10701-009	9	121
10701-010	10	134
10701-011	11	147
10701-012	12	160

Note:Used for ulna, radius fracture with HA3.5 locking screws, HA3.5 cortical screws. Instrument set: 15059, Simple set for small bone LOC system
Combined Hole is available

10700
Humerus LOC plate

Product No.	Holes	Length(mm)
10700-005	5	69
10700-006	6	82
10700-007	7	95
10700-008	8	108
10700-009	9	121
10700-010	10	134
10700-011	11	147
10700-012	12	160

Note:Used for humeral shaft fracture with HA3.5 locking screws, HA3.5 cortical screws. Instrument set: 15059, Simple set for small bone LOC system
Combined Hole is available.

10708
Proximal humeral LOC plate II

Product No.		Holes	Length(mm)
10708-003	L	3	88
10708-103	R		
10708-004	L	5	120
10708-104	R		
10708-005	L	7	152
10708-105	R		
10708-006	L	9	184
10708-106	R		
10708-007	L	11	216
10708-107	R		

Note:Used for proximal humeral fracture with HA3.5 locking screws, HA3.5 cortical screws, HB4.0 cancellous screws. Instrument set: 15059, Simple set for small bone LOC system
Combined Hole is available.

10735
Proximal humeral LOC plate II

Product No.	Holes	Length(mm)
10735-003	3	90
10735-004	4	102
10735-005	5	114
10735-006	6	146
10735-008	8	178
10735-010	10	210
10735-012	12	242

Note:Used for proximal humeral fracture with HA3.5 locking screws, HA3.5 cortical screws, HB4.0 cancellous screws. Instrument set: 15059, Simple set for small bone LOC system
Combined Hole is available.

10718

Distal medial humeral LOC plate

Product No.		Holes	Length(mm)
10718-003	L	3	85
10718-103	R		
10718-004	L	5	111
10718-104	R		
10718-005	L	7	137
10718-105	R		
10718-006	L	9	163
10718-106	R		
10718-006	L	11	189
10718-106	R		
10718-006	L	13	215
10718-106	R		

Note:Used for distal medial humeral fracture, supracondylar fracture of humerus and nonunions of humeral fracture, HA2.7 locking screws for head part of this plate, and HA3.5 locking screws, HA3.5 cortical screws and HB4.0 cancellous screws.
nstrument set: 15059, simple set for small bone Loc system(Page81) & 15066 extra instrument set for HA2.7 locking screws.
Combined Hole is available.

10719

Distal lateral humeral LOC plate I

Product No.		Holes	Length(mm)
10719-003	L	3	64
10719-103	R		
10719-005	L	5	90
10719-105	R		
10719-007	L	7	116
10719-107	R		
10719-009	L	9	142
10719-109	R		
10719-011	L	11	168
10719-111	R		
10719-013	L	13	194
10719-113	R		

Note:Used for distal humeral fracture, supracondylar fracture of humerus and nonunions of humeral fracture, HA2.7 locking screws for head part of this plate, and HA3.5 ocking screws, HA3.5 cortical screws and HB4.0 cancellous screws.
Instrument set: 15059, simple set for small bone Loc system(Page81) & 15066 extra instrument et for HA2.7 locking screws.
Combined Hole is available.

10719

Distal lateral humeral LOC plate II

Product No.		Holes	Length(mm)
10719-203	L	3	61
10719-303	R		
10719-205	L	5	87
10719-305	R		
10719-207	L	7	113
10719-307	R		
10719-209	L	9	139
10719-309	R		
10719-211	L	11	165
10719-311	R		
10719-213	L	13	191
10719-313	R		

Note:Used for distal humeral fracture, supracondylar fracture of humerus and nonunions of humeral fracture, HA3.5 locking screws for head part of this plate, and HA3.5 locking screws, HA3.5 cortical screws and HB4.0 cancellous screws.
Instrument set: 15059, Simple set for small bone LOC system .
Combined Hole is available.

10717
Olecranon LOC plate

Product No.	Holes	Length(mm)
10717-003	3	62
10717-004	4	74
10717-005	5	86
10717-006	6	98
10717-007	7	110
10717-008	8	122

Note:Used for proximal lateral ulnar fracture with HA3.5 locking screws, HA3.5 cortical screws, HB4.0 cancellous screws. Instrument set: 15059, Simple set for small bone LOC system.
Combined Hole is available.

10710
Small T-LOC plate

Product No.	Holes	Length(mm)
10710-003	3	47
10710-004	4	58
10710-005	5	69
10710-006	6	80

Note:Used for distal radius fracture and fracture of acromion with HA3.5 locking screws. Instrument set: 15059, Simple set for small bone LOC system .
Combined Hole is available.

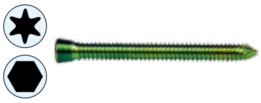
10711
Proximal humeral LOC plate II

Product No.		Holes	Length(mm)
10711-003	L	3	46
10711-103	R		
10711-004	L	5	57
10711-104	R		
10711-005	L	7	68
10711-105	R		
10711-006	L	6	79
10711-106	R		

Note:Used for distal radius fracture and fracture of acromion with HA3.5 locking screws, HA3.5 cortical screws, HB4.0 cancellous screws. Instrument set: 15059, Simple set for small bone LOC system .
Combined Hole is available.

Screws

HA2.7 / HA3.5 / HA5.0 Locking Screw
(Self–tapping,Torx)

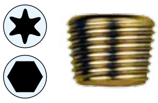


Product No.	Dia	Length(mm)
10750–(010–060)	HA2.7	10–40In (2mm increments)
		45–60(5mm increments)
10750–(112–160)	HA3.5	12–32(2mm increments)
		35–60(5mm increments)
10750–(114–150)	HA5.0	14–50(2mm increments)
10750–(055–110)		55–110(5mm increments)

HA3.5 / HA5.0 Locking Screw(Self–tapping and Self–drilling)

Product No.	Dia	Length(mm)
10752–(010–060)	HA3.5	16–60
10754–(022–080)	HA5.0	22–80

Locking Spacer



Product No.	Length(mm)
10751–210	4
10755–215	5

Note:Used for Loc plates of upper and lower limbs fracture.

Instruments

Drill bit 2.0 2.5 2.7

Tap HA3.5

Threaded drill guide 3.0

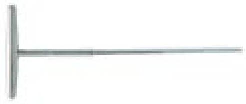
Screw driver (hex 2.5) & screw holding guide

Plate bending wrench

Drill sleeve (2.5&3.5)

Depth gauge

Tap loc ha3.5



Quick coupling screw driver SW2.5

T15 screwdriver (torx)

Quick coupling torque spanner 1.5

Torque spanner 1.5N