

## L1<sup>®</sup> Rib

Thoracic Fixation System



Osteosyntheses are our passion! It is our aspiration to develop them further together with our customers. Every day we work to develop innovative products and services that meet the highest quality standards and contribute to the well-being of the patient.

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## L1® Rib

### The smart, simple, secure Solution featuring CB3 Technology

Rib fractures are one of the most common injuries following blunt trauma, occurring in approximately 10% of all trauma patients. Traditional treatment of rib fractures includes supportive measures such as incentive spirometers, oxygen and ventilator support, and pain management via medications. In patients who receive non-operative care, the contribution of rib fractures to long-term pain and disability is greater than traditionally expected.

Surgical stabilization of rib fractures with titanium plates and screws assists in immobilizing the fracture, allowing for proper healing while maintaining normal respiratory function.

The L1® Rib system with its convergent biaxial 3-dimensional fixation (CB3) technology has specifically been designed for the shape, size and complex geometry of fractured ribs. This design concept, combined with an optimized plate selection results in a system that helps mitigate risk of harming soft tissue, increase operative efficiency and provide proper fixation for rib fractures.

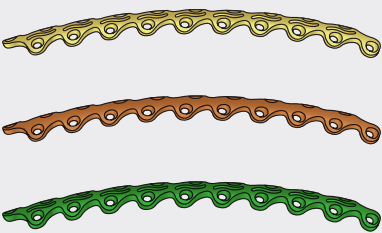
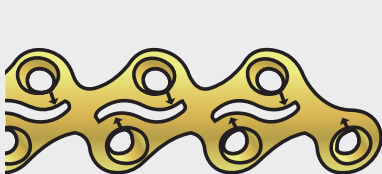
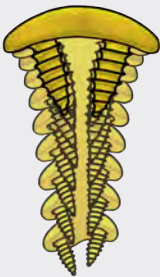
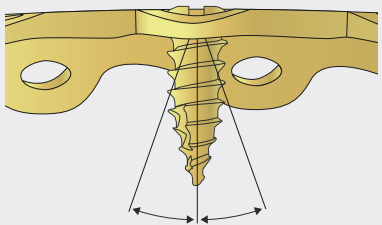
## Feature, Function and Benefit



The L1® Rib system provides a large product range of plates that can be equipped with a sufficient number of locking screws in order to treat different patterns of injuries of the chest wall, including rib and rib serial fractures.

The bones of the rib have a continuous curve in all aspects, making rib fracture titanium plate design a challenge. To overcome the 'shape' challenge, the L1® Rib system comes along with a smart design based on average patient curves with an adaptive and strong geometrical plate design.

## L1® Rib Implants

Feature	Benefit
	<ul style="list-style-type: none"> <li>▪ Smart shape design based on average patient data</li> <li>▪ Enables the same plates to be applied to any rib shape</li> <li>▪ Decreasing inventory</li> <li>▪ Improving overall system ease of use</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Special X-shape design with minimal footprint</li> <li>▪ Allows for more screws per area of rib than conventional reconstruction plates</li> <li>▪ Enables physical placement in a smaller segment of bone, smaller dissection or retraction area and easier precision in placement</li> <li>▪ Frees up the rib for natural movement</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Convergent biaxial fixation technology engages more bone</li> <li>▪ Secure osteosynthesis is possible using monocortical screws</li> <li>▪ Only one screw length required which simplifies the application and ease of use by eliminating the need of drilling and screw length measurement</li> <li>▪ Helps to mitigate risk of harming soft tissue, increase operative efficiency and provide proper fixation for rib fractures</li> </ul>
	<ul style="list-style-type: none"> <li>▪ ThreadLock TS multidirectional locking screw</li> <li>▪ Drill-free screw</li> <li>▪ Single pitch locking mechanism that allows for up to 20 degrees of angulation in any direction</li> <li>▪ No need for pre-drilling</li> <li>▪ No need for careful drilling, depth measurement and screw placement, which is required for traditional bicortical fixation</li> </ul>

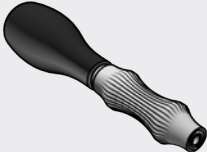
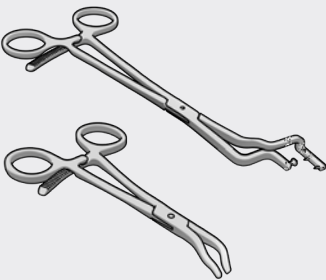
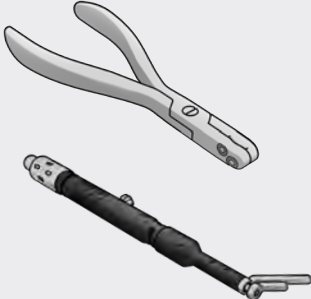
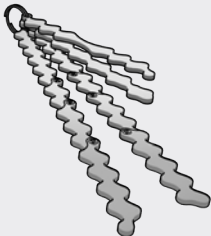
## Feature, Function and Benefit



The L1® Rib system offers a carefully selected instrument portfolio with module-specific as well as cross-module instruments. For easy identification and assignment of the instruments, the instruments are arranged according to their order of use in surgery.



## L1® Rib Instruments

	Feature	Benefit
	<ul style="list-style-type: none"><li>▪ Clear assignment while high compatibility of different instruments</li></ul>	<ul style="list-style-type: none"><li>▪ Interchangeability of instruments with clear focus on functionality</li></ul>
	<ul style="list-style-type: none"><li>▪ Reduction forceps and plate holding forceps designed to suit the anatomy of the rib</li><li>▪ Unique shaped design of the working ends</li></ul>	<ul style="list-style-type: none"><li>▪ Easy, reliable reduction of the fracture</li><li>▪ User-friendly handling allowing access to the ribs in all common approaches</li></ul>
	<ul style="list-style-type: none"><li>▪ Drill guide for inserting screws in a predefined trajectory</li><li>▪ Simple design and handling of the bending devices</li><li>▪ Single-hand usage possible with most instruments</li></ul>	<ul style="list-style-type: none"><li>▪ Proper fixation of the plate onto the rib</li><li>▪ Easy adaptation of the plate curvature to the rib anatomy</li><li>▪ Combination of surgical steps allows reduction of surgical time</li></ul>
	<ul style="list-style-type: none"><li>▪ Sizer available for all plates</li></ul>	<ul style="list-style-type: none"><li>▪ Template reflects the plate 1-to-1</li><li>▪ Easier bending of the sterile-packed plate</li><li>▪ Bending of the template according to the rib shape. When the template has been removed, the plate can be bent as required by adapting to the template.</li></ul>

## Feature, Function and Benefit

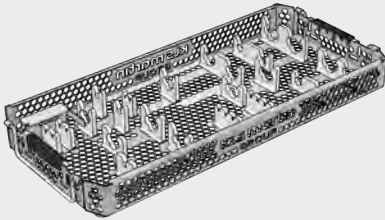


The L1® Rib system is rounded off by a modular storage concept with user-specific configuration options.

## L1® Rib Storages

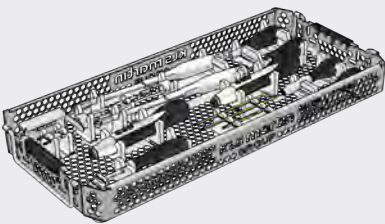
### Feature

### Benefit



- Stainless steel storage tray in honeycomb design combined with high-performance plastic

- High stability, but low weight
- Good rinsing results thanks to large openings
- No water residues



- The instruments are arranged according to their order of use in surgery

- Swift and intuitive passing of instruments during surgery
- User-friendly, efficient instrumentation



- Mobile sterile goods trolley

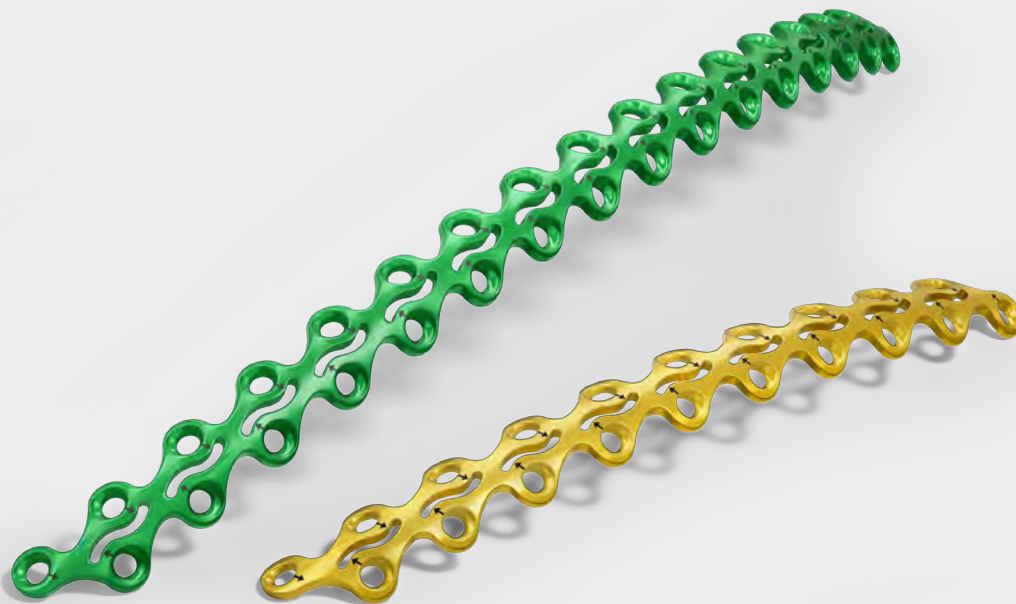
- Easy handling and supply of sterile implants in the operating room
- Optimal protection of sterile packages
- Swivel casters enable easy transport and transfer to and between operating rooms

## Step by Step to optimal Treatment

### Fields of Use

The L1® Rib plating system is indicated for surgeries requiring osteosynthesis of the chest wall, including

- stabilization and fixation of fractures,
- osteotomies,
- reconstructive procedures.



## Surgical Technique

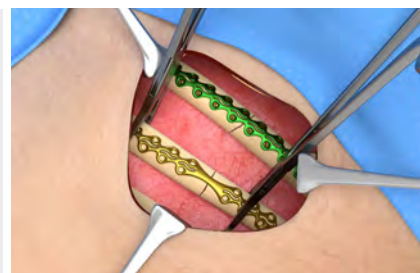
**Treatment of a rib fracture**  
with L1® Rib plate and screws

Pages 16 - 26



**Implantation of special plates**

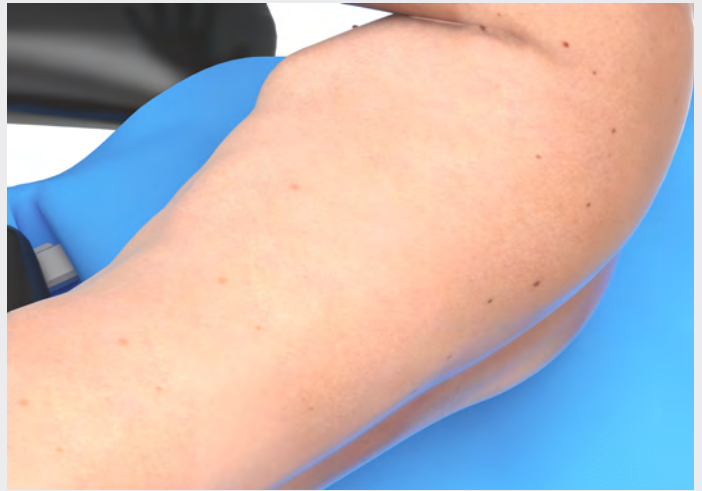
Pages 27 - 29





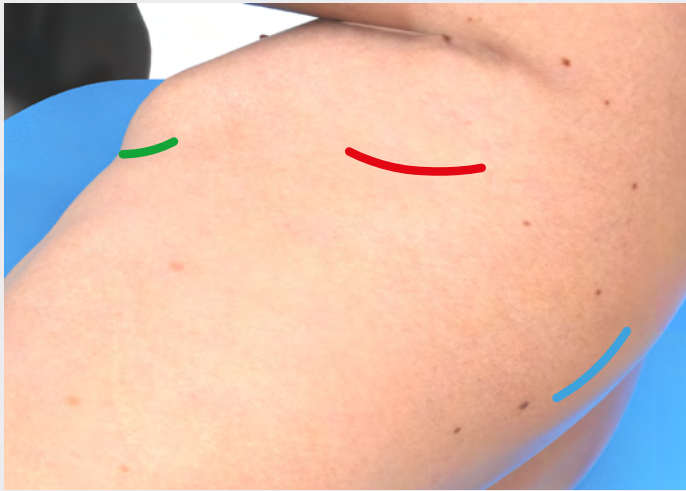
### Preoperative planning

X-ray scans of the fractured rib series in appropriate views is standard practice for pre-operative planning.



### Preparation of the surgery

Based on the indication and the preoperative planning, the appropriate surgical approach is chosen. For surgery, the patient is positioned on the operating table accordingly.



### Approaches to the rib fracture site

The following approaches only describe a possible way to use the rib fixation plates, screws and instruments.

**Axillary approach:**                **Red line**

**Paraspinal approach:**        **Blue line**

**Submammary approach:**    **Green line**



### Positioning of the patient – axillary approach

The patient is positioned in lateral position in which the person lies on the side with the back and dorsal side towards the surgeon while the chest and ventral side facing away from the surgeon.



**Positioning of the patient – paraspinal approach**

The patient is positioned in prone position in which the person lies flat with the chest and ventral side down while the back and dorsal side facing up.



**Positioning of the patient – submammary approach**

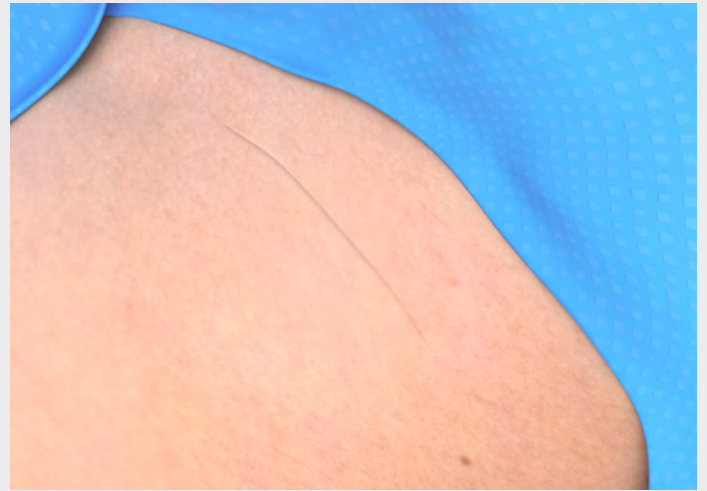
The patient is positioned in supine position in which the person lies flat with the back and dorsal side down while the chest and ventral side facing up.



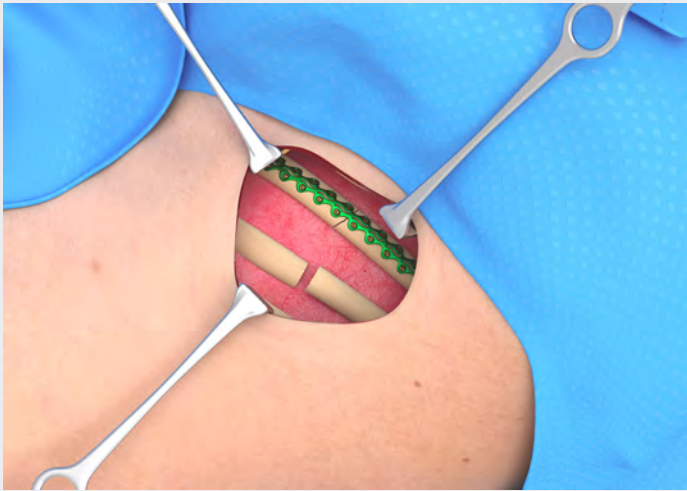


### **Positioning of the patient**

The position of both the patient and the operating table in the room must enable the use of a mobile X-ray equipment to perform basic projections (antero, posterior and lateral) and oblique projections. Putting the patient on a carbon table is recommended.

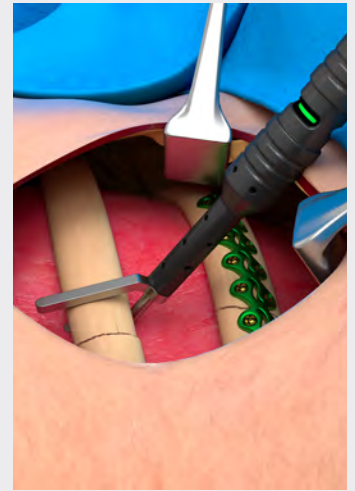
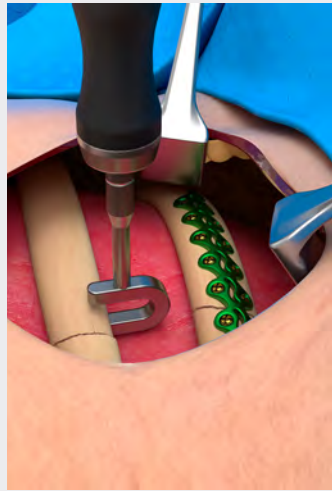


### **Surgical incision**



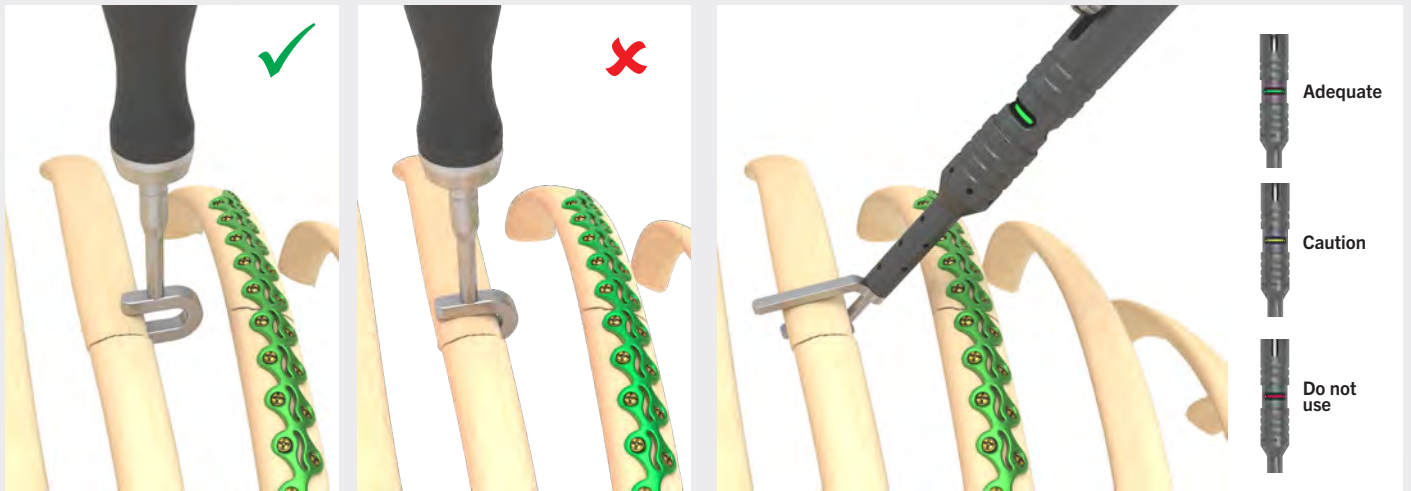
### 1. Expose the rib

Expose the fractured rib to allow a minimum of three screws on each side of the fracture. Remove any non-viable bone.



### 2. Ensure the rib has adequate thickness

If there is no existing incision in the location where screws are desired, then make a small incision in the intercostal space at the superior border of the rib to allow insertion of a caliper. Insert the tri color depth gauge tip (2a) or fixed depth gauge tip (2b) through the incision and measure the rib thickness.



### 2a. Fixed depth gauge

The fixed depth gauge provides a simple method of measuring the minimum thickness of the fractured rib.

If the fixed depth gauge fits over the rib, use the adjustable gauge to determine if screw placement is possible.

If the fixed depth gauge does not fit over the rib, then the rib thickness is greater than 7 mm. This thickness is adequate for placement of screws with or without the screw guide controlling the angle of insertion.

### 2b. Tri color depth gauge

Push the sliding button to extend the working ends around the rib. The tip is spring loaded and will close down on the rib automatically when released. After releasing the button read the display window.

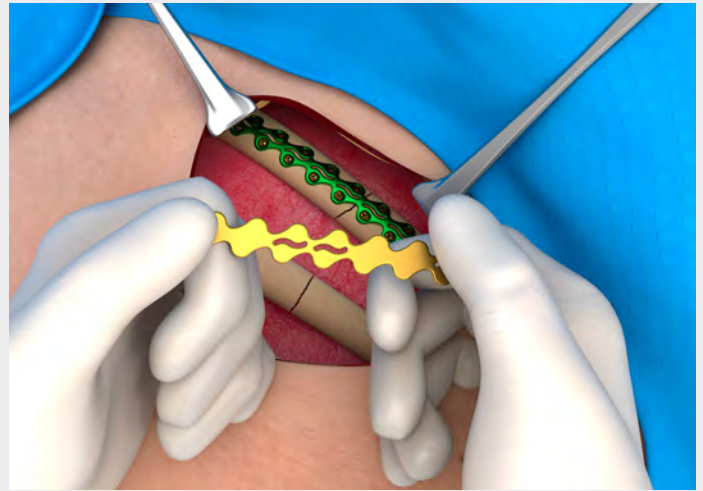
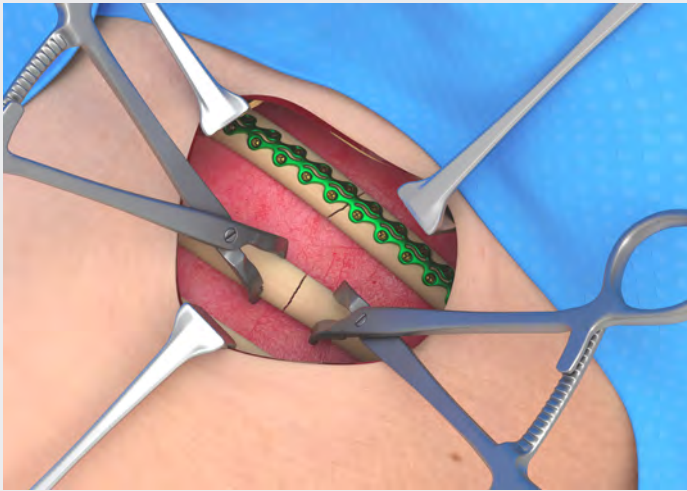
- Rib has adequate thickness.
- Caution: Use only with the CB3 screw guide.
- Do not use.



24-015-51-07  
Fixed depth gauge



24-015-50-07  
Tri color depth gauge



**3. Approximate the broken rib segments with the rib bone holding forceps**

In cases of displaced fractures, use bone repositioning instruments to reposition the bone segments in order to close the displacement.

**4. Cut and contour the plate template (optional)**

Place the template over the area where plate coverage is desired, ensuring a minimum of three screws in each segment. If desired, cut the template to the correct size.

The template may also be used to aid in contouring the plate to match the bone surface. The template is malleable and may be manually shaped to the bone contour.



24-015-54-07  
Rib bone holding forceps



24-015-63-09  
Bending template



### 5. Select and cut plate

The surgeon must select the appropriate plate for fracture fixation. If necessary, cut the plate based on your template measurements using the double action plate cutter.

A deburring attachment may be used to smooth any rough edges along the cut section.

**Caution:**

The surgeon should ensure that the fractured segment has bone to bone contact and no continuity defect exists. Any bridging of a continuity defect must be combined with a bone graft.



### 6. Contour the plate

Using the bending pliers with the screw hole etching facing up, contour the plate to match the template. The CB3 bending pliers have been specially designed to retain the surface curvature and protect hole integrity while bending.

**Caution:**

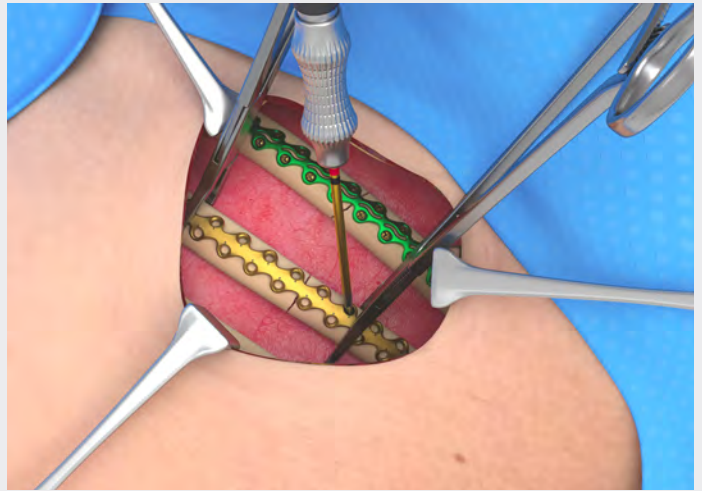
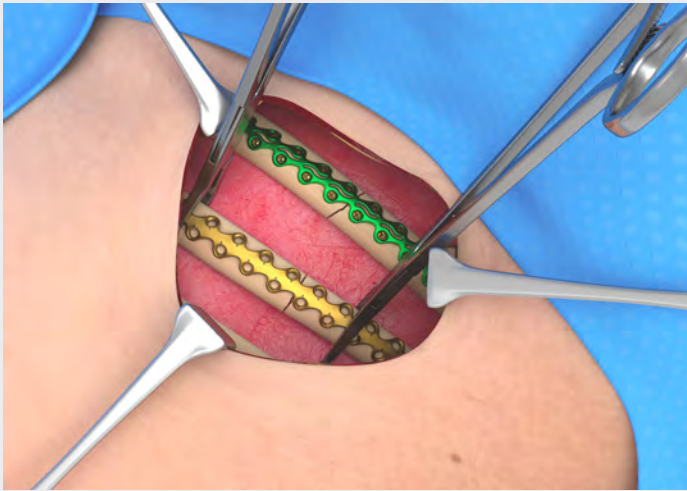
If contouring is necessary, avoid sharp bends, reverse bends, or bending the implant at a screw hole. Avoid notching or scratching the implant. These factors may produce internal stresses which may become the focal point for eventual breakage of the implant.



22-523-22-07  
Double action plate cutter



24-015-55-07  
CB3 bending pliers



### 7. Position the plate

Position the plate on the rib over the fracture, allowing a minimum of three screws on each side of the fracture. Verify that the contour of the plate matches the rib. Place the plate on the rib.

**Caution:**

It is recommended to insert the forceps from the superior border of the rib to avoid damaging the nerve and vessel bundle located at the inferior border of the rib.

### 8. Select and insert the screw

The ThreadLock TaperScrew technology in the screw and plate allows up to 20 degrees of angulation; however, ideal placement angulation can easily be done with the CB3 screw guide. It is recommended to use this option if the adjustable depth guide indicated a yellow caution thickness.

The surgeon should ensure the screws enter the plate at a correct angle if the screw guide (see step 8a) is not used. Directional markings are etched onto the plate surface to aid in correct angulation.

Alternatively the screw can be inserted with a battery-powered screwdriver (e.g. our BOS HT driver). If a battery-powered screwdriver is used, make sure the screws are tight and further secure them with a manual screwdriver.

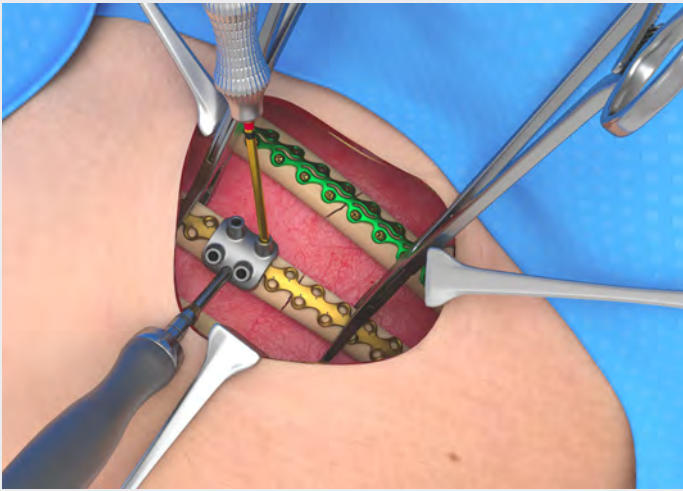
For placement of screws in the sub-scapular approach or in areas where a straight screwdriver may not be utilized, the Angulus 2 angled screwdriver is ideal.



24-015-74-07  
Long straight plate  
holding forceps



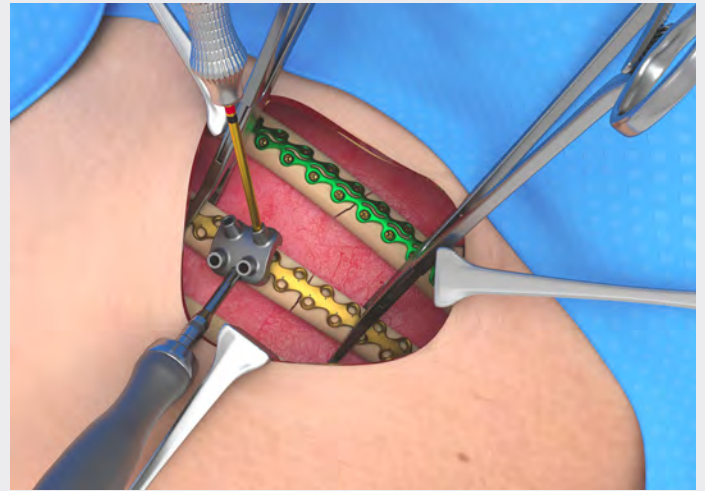
24-015-66-07  
Short straight plate  
holding forceps



**8a. Screw insertion with thumb twist screwdriver handle and blade with CB3 screw guide**

To load the screwdriver blade into the driver, retract the collar and fully insert the hexagonal blade. Release the collar and ensure that the blade is securely seated. The collar should return to the flush position if the blade is fully inserted.

Place the screw guide over the plate to ensure the screws enter the plate at the correct angle and orientation. Using the thumb twist screwdriver, place the 7-mm screws (with minimum rib thickness determined in Step 2) through the CB3 screw guide and into the plate. Tighten until secure. Ensure that each screw is completely locked into the plate.



**8b. Removal of screwdriver blade**

Remove the screwdriver blade from the screw by lifting the CB3 screw guide and rocking the screwdriver blade back and forth.



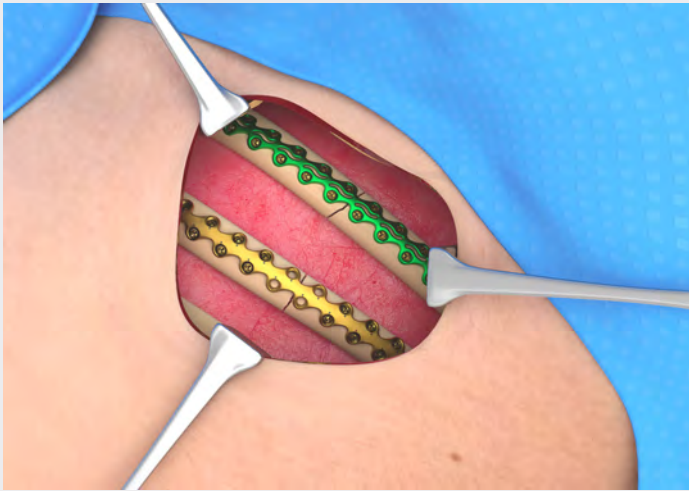
24-015-59-07  
CB3 screw guide



25-407-03-04  
Screwdriver



25-486-97-07  
Screwdriver blade



### 9. Insert screws

Ensure that the screws are completely locked into the plate. Surgeon should ensure proper fracture reduction and plate placement.

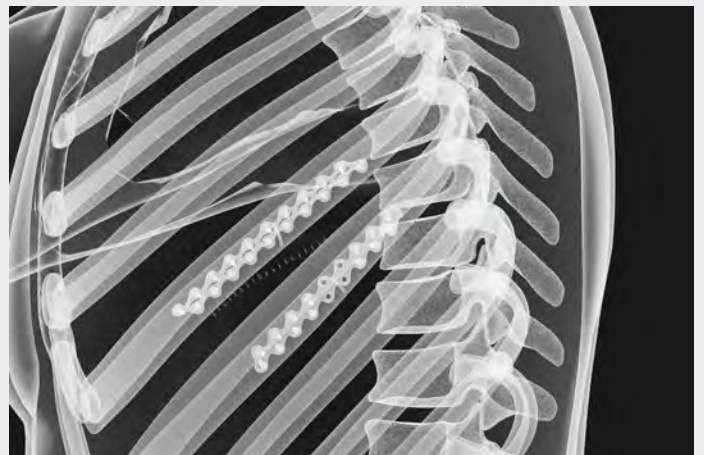
### 10. Wound closure / post operative treatment

Close the wound according your surgical preference.

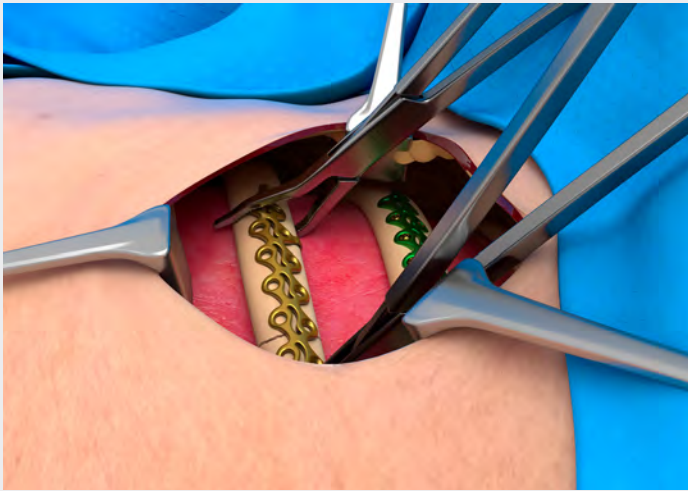
The postoperative activities are defined by the surgeon and set individually for each patient. The surgeon is responsible to inform the patient about the correct way to reach the best healing outcome.

Note:

X-Ray control may be needed by the surgeon to check the healing outcome.







## Specialty plate implantation

### Tabbed plate

Using the bending pliers, bend the tabs on the plate to a 90° angle with the superior edge of the plate. These tabs will assist in plate alignment.

Position the plate on the rib over the fracture, allowing a minimum of three screws on each side of the fracture. The tabs will rest on the superior aspect of the rib to ensure that the plate is aligned properly. Verify that the contour of the plate matches the rib. The plate holding forceps are specially designed to hold the plate on the rib. Proceed to step 8 for screw placement instructions.

### Caution

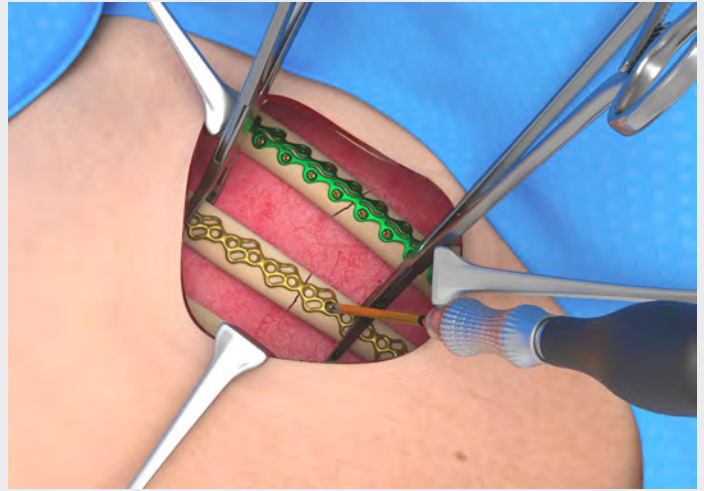
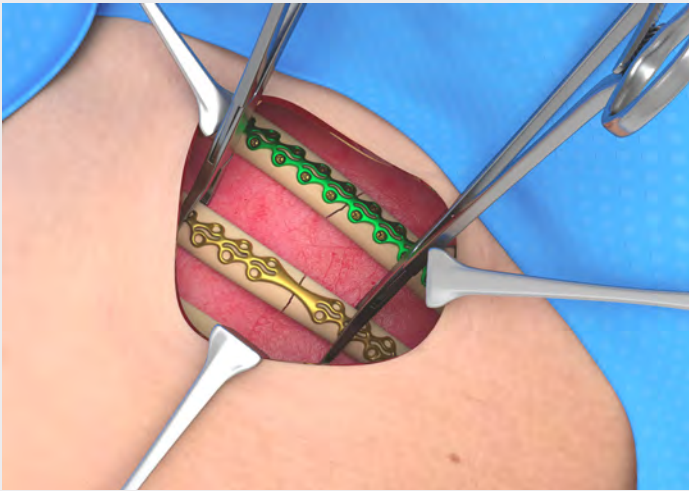
When using the tabbed plate, the surgeon must not bend the tabs in a back and forth motion as this may weaken the tabs, causing them to fracture. Avoid unnecessary bending.

The tabs are for alignment purposes only and do not provide any additional fixation. The tabs should be aligned on the superior border of the rib and screws should be placed in the same manner as other rib plates.

The surgeon must ensure that the tabs are not interfering with any important anatomical structures and are not protruding into the pleural space.



24-015-55-07  
CB3 bending pliers



### Spar plate

Position the plate on the rib over the fracture, allowing a minimum of three screws on each side of the fracture. The spar of the plate should be aligned over the fracture, leaving the screws holes on each side of the fracture. If possible, screws should be placed in the holes adjacent to the spar. Verify that the contour of the plate matches the rib. The plate holding forceps are specially designed to hold the plate on the rib.

Proceed to Step 8 for screw placement instructions.

### Caution

It is recommended to insert the forceps from the superior border of the rib to avoid damaging the nerve and vessel bundle located at the inferior border of the rib.

### Caution

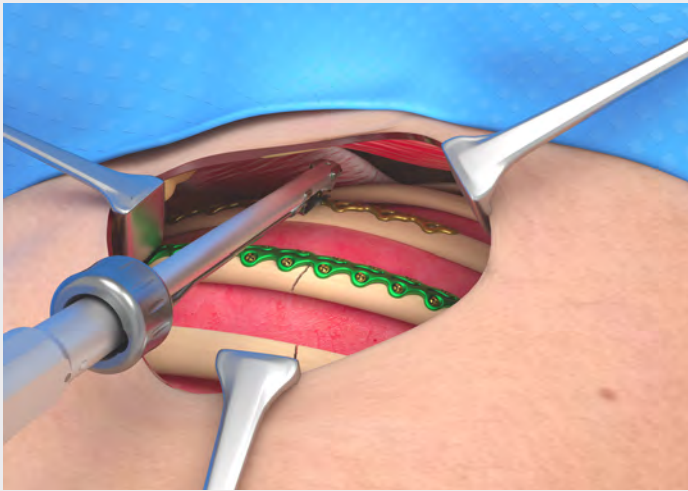
When using the spar plate, the surgeon must ensure the spar is aligned over the fracture site and that a minimum of three screws are placed on each side of the fracture. Failure to align the plate properly may result in inadequate fixation of the fracture.

### Universal plate

This plate is used in situations where access is challenging and no space is available to place screws laterally on the plate. The ThreadLock TaperScrew technology in the screw and plate allows up to 20 degrees of angulation.

It is recommended to use this plate only when the adjustable depth guide indicates a green thickness.

In order to avoid unnecessary widening of the wound or stretching of the skin, the Angulus screwdriver can be used for insertion of the screws. With its small working end, it allows screw insertion even in very narrow regions, e.g. underneath the scapula.



### Use of Angulus screwdriver

Using the bending pliers, bend the tabs on the plate to a 90° angle with the superior edge of the plate. These tabs will assist in plate alignment.

Position the plate on the rib over the fracture, allowing a minimum of three screws on each side of the fracture. The tabs will rest on the superior aspect of the rib to ensure that the plate is aligned properly. Verify that the contour of the plate matches the rib. The plate holding forceps are specially designed to hold the plate on the rib. Proceed to step 8 for screw placement instructions.

### Caution

When using the tabbed plate, the surgeon must not bend the tabs in a back and forth motion as this may weaken the tabs, causing them to fracture. Avoid unnecessary bending.

The tabs are for alignment purposes only and do not provide any additional fixation. The tabs should be aligned on the superior border of the rib and screws should be placed in the same manner as other rib plates.

The surgeon must ensure that the tabs are not interfering with any important anatomical structures and are not protruding into the pleural space.



50-990-00-07  
Angulus 2 angled screwdriver



50-991-20-07  
maxDrive® blade 2.0/2.3  
for Angulus 2


## Implants L1® Rib – Maleable Plates in Profile Thickness 1.5 mm



1/1

24-015-20-71 Ti 1 1.5

10 holes, X-plate, 55 mm length


 = 1.5 mm



1/1

24-015-22-71 Ti 1 1.5

20 holes, X-plate, 106 mm length


 = 1.5 mm



1/1

24-015-25-71 Ti 1 1.5

32 holes, X-plate, 163 mm length

 = 1.5 mm

24-015-61-71 Al 1


Bending template

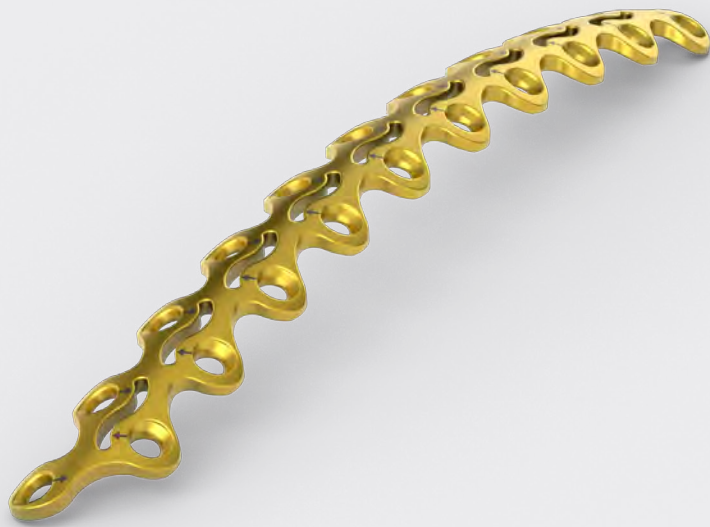


1/1

24-015-29-71 Ti 1 1.5

14 holes, X-plate, 90 mm length

 = 1.5 mm



Explanation of icons

- Ti CP Titanium
- 1 Quantity / units per package
- Multidirectional locking screw hole
- Plate profile
- Al Aluminum
- STERILE | R Sterile

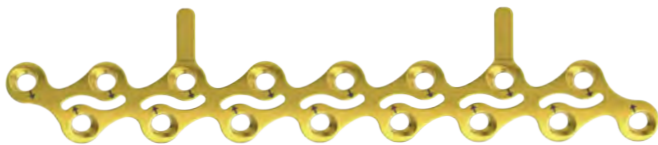


1/1

24-015-30-71 Ti 1

14 holes, universal straight, 103 mm length

= 1.5 mm



1/1

24-015-31-71 Ti 1

16 holes, tabbed plate, 85 mm length

= 1.5 mm



1/1

24-015-32-71 Ti 1

16 holes, solid plate, 85 mm length

= 1.5 mm



1/1

24-015-35-71 Ti 1




20 holes, solid plate, 102 mm length

= 1.5 mm


## Implants L1® Rib – Semi Rigid Plates in Profile Thickness 1.5 mm



1/1




24-015-43-71   

10 holes, solid plate, 51 mm length


 = 1.5 mm



1/1




24-015-44-71   

16 holes, solid plate, 82 mm length


 = 1.5 mm



1/1




24-015-46-71   

20 holes, solid plate, 102 mm length


 = 1.5 mm



1/1





24-015-47-71   

32 holes, solid plate, 159 mm length

 = 1.5 mm






Explanation of icons

-  CP Titanium
-  Quantity / units per package
-  Multidirectional locking screw hole
-  Plate profile


**STERILE**  Sterile



1/1




24-015-49-71   

16 holes, spar plate, 97 mm length


 = 1.5 mm

## Implants L1® Rib – Rigid Plates in Profile Thickness 2.0 mm






24-015-33-71   


10 holes, solid plate, 51 mm length

 = 2.0 mm






24-015-34-71   


16 holes, solid plate, 82 mm length

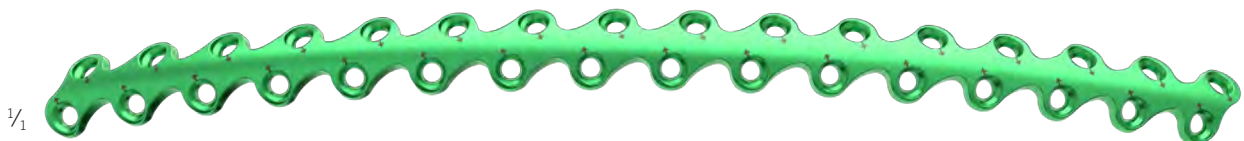
 = 2.0 mm






24-015-36-71   


20 holes, solid plate, 102 mm length

 = 2.0 mm

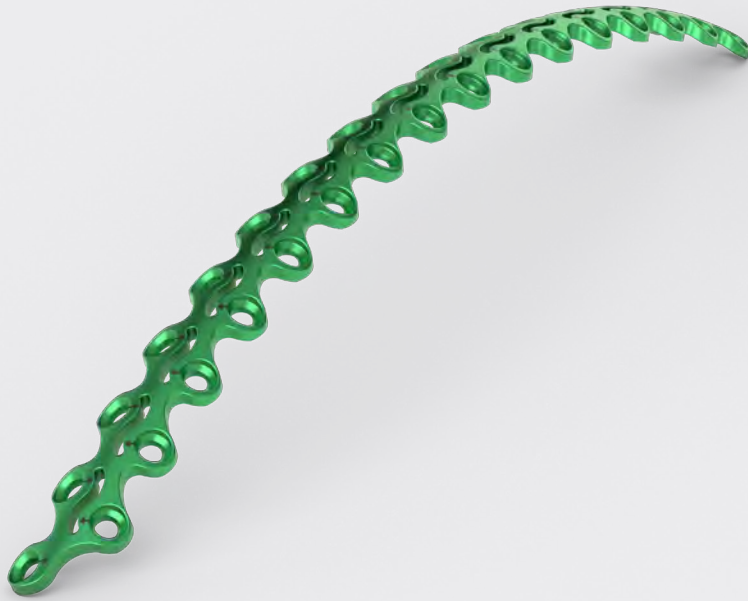


24-015-37-71   





32 holes, solid plate, 159 mm length

 = 2.0 mm








Explanation of icons

-  CP Titanium
-  Quantity / units per package
-  Multidirectional locking screw hole
-  Plate profile


**STERILE**  Sterile

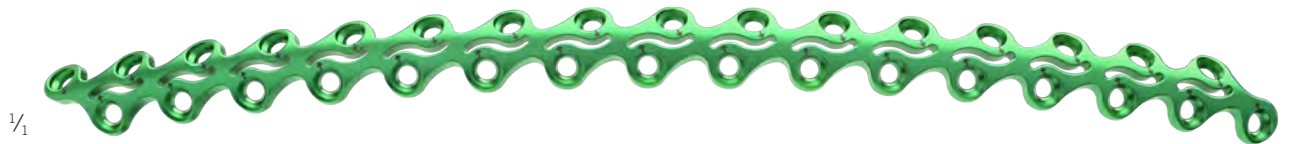


1/1

24-015-39-71   

16 holes, spar plate, 97mm length


 = 2.0 mm




1/1

24-015-26-71   

32 holes, X-plate, 163 mm length

 = 2.0 mm

## Implants and Instruments L1® Rib – maxDrive® Screws and Screwdrivers

Drill-Free® maxDrive® Ø 2.3 mm self retaining				
		1	4	10
	2.3 x 7 mm	24-016-07-71	24-016-07-74	24-016-07-70



50-800-02-71  
Battery pack for  
50-800-04-07

1



50-800-04-07  
BOS driver "HT"  
(without battery pack)

1



25-407-03-04  
Screwdriver handle  
silicone

Sic St 1



50-990-00-07  
Angulus 2 angled screwdriver  
complete

St 1



50-991-20-07  
maxDrive® blade  
2.0/2.3 for Angulus 2

St 1



Explanation of icons

- Titanium alloy
- Quantity / units per package
- maxDrive®
- J-coupling
- Dental coupling
- Angulus coupling
- STERILE | R** Sterile

Optional:

Twist drills				
	<b>J- notch</b>			
	<b>Ø x L (mm)</b>	<b>Stop (mm)</b>	<b>STERILE   R</b>	
	1.5 x 50	7	25-449-07-07	
	1.5 x 50	7	25-449-07-91	
	1.5 x 50	7	25-449-07-71	
<b>Dental attachment</b>				
<b>Ø x L (mm)</b>	<b>Stop (mm)</b>	<b>Item number</b>		
1.5 x 20	7	50-924-07-07		
1.5 x 45	7	25-459-07-07		
	<b>Angulus</b>			
	<b>Ø (mm)</b>	<b>Stop (mm)</b>	<b>Item number</b>	
1.5	7	50-996-07-07		



50-817-20-07  
maxDrive® blade 2.0/2.3  
40 mm



25-486-97-07  
maxDrive® blade 2.0/2.3  
80 mm



24-015-58-07  
maxDrive® blade 2.0/2.3  
130 mm

## Instruments L1® Rib – Repositioning Instruments



1/2

24-015-54-07

14 cm, 5 1/2"

Rib bone holding forceps,  
press style

St 1



1/2

24-015-76-07

20.5 cm, 7"

Rib bone holding forceps

St 1



1/2

24-015-65-07

16 cm, 6"

Rib forceps, small box

St 1

Explanation of icons

St Stainless steel

1 Quantity / units per package



1/2

24-015-68-07  
27 cm, 10"  
Rib forceps, large box

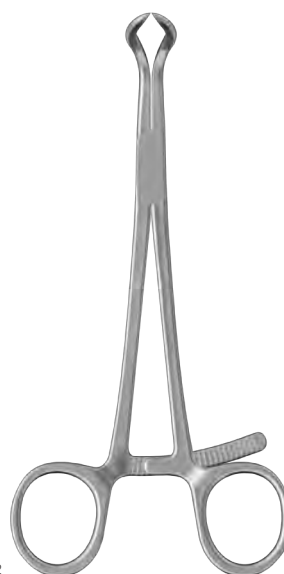
St 1



1/2

23-539-15-07  
16 cm, 6 1/4"  
Bone lever

St 1

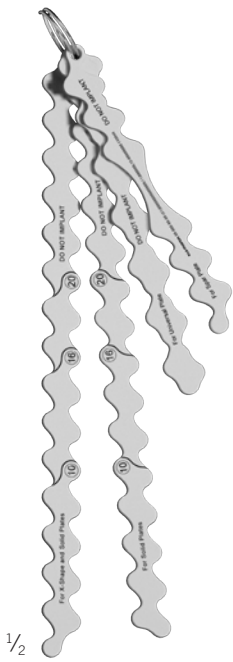


1/2

24-015-70-07  
15 cm, 6"  
Rib grasping forceps

St 1

## Instruments L1® Rib – Osteosynthesis Instruments



1/2  
24-015-63-09  
Implant sizer set

St 1



1/2  
24-015-50-07  
19 cm, 7 1/2"  
Tri color depth gauge

St 1



1/2  
24-015-51-07  
14 cm, 5 1/2"  
Fixed depth gauge

St 1



1/2  
22-523-22-07  
22 cm, 8 3/4"  
Double action plate cutter,

St 1 TC GOLD

Explanation of icons

**St** Stainless steel

**Sic** Silicone

**1** Quantity / units per package

**TC GOLD** Instrument with tungsten carbide inserts



1/2

24-015-55-07  
14 cm, 5 1/2"  
CB3 pliers

**St** **1**



1/2

12-188-17-07  
17.5 cm, 6 3/4"  
Cushing forceps,  
serrated

**St** **1**



1/2

24-015-59-07  
14 cm, 5 1/2"  
CB3 screw guid,

**Sic** **St** **1**

## Instruments L1® Rib – Plate Holding Instruments



1/2

24-015-72-07

21.5 cm, 8 1/2"

Rib plate holding forceps,  
press style

St 1



1/2

24-015-69-07

19 cm, 7"

Rib plate holding forceps,  
press style, rotating

St 1



1/2

24-015-53-07

17.7 cm, 7"

Rib plate holding forceps,  
long, straight

St 1





Explanation of icons

- St** Stainless steel
- Sic** Silicone
- 1** Quantity / units per package



$\frac{1}{2}$   
 24-015-71-07  
 20 cm, 7"  
 Rib plate holding forceps,  
 vertical

**St 1**



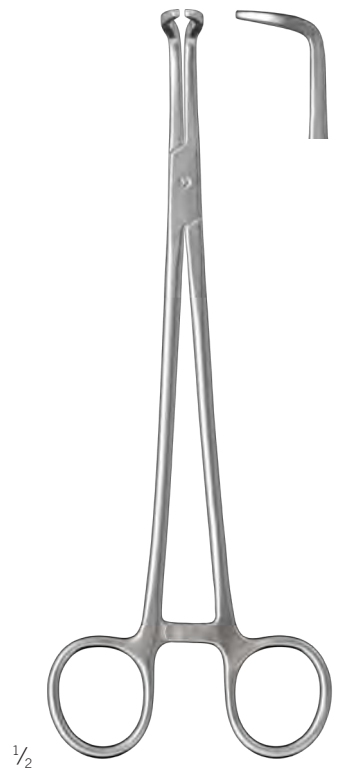
$\frac{1}{2}$   
 24-015-66-07  
 13.5 cm, 5"  
 Rib plate holding forceps,  
 narrow tip

**St 1**



$\frac{1}{2}$   
 24-015-74-07  
 20 cm, 8"  
 Rib plate holding forceps,  
 narrow tip

**St 1**



$\frac{1}{2}$   
 24-015-75-07  
 20 cm, 8"  
 Rib plate holding forceps,  
 right angle

**St 1**

## Storages L1® Rib

The storage concept has been matched to the special requirements of the L1® Rib fixation system. The instruments have been split between the various trays in order of their use. This allows the user to quickly identify which tray should be accessed to retrieve the correct instrument.

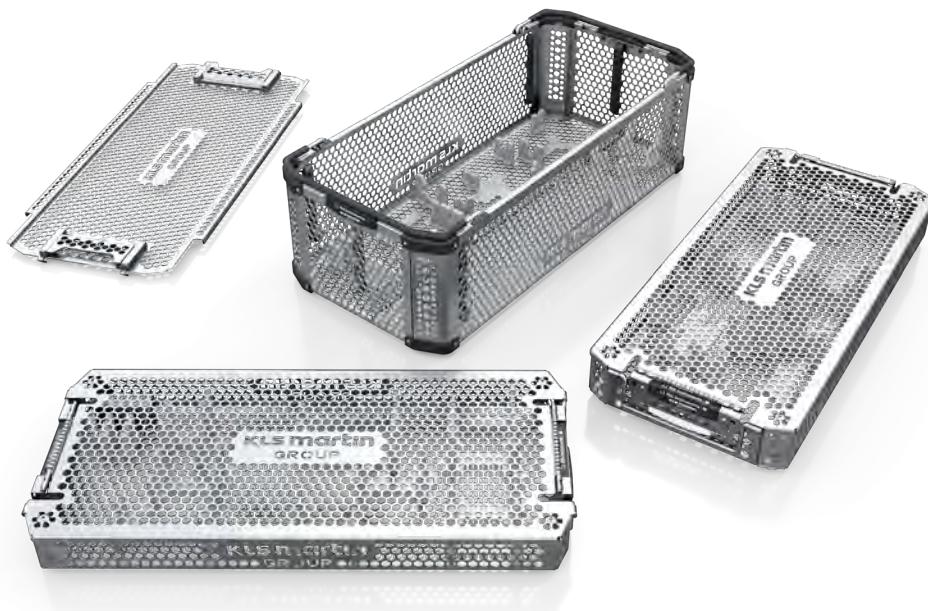
The instruments are stored next to each other, in the manner according to the typical sequence of their use.

In addition to easy, well-thought-out handling, the storage system is particularly impressive because of its optimized reprocessing capability, due to large openings of the honeycomb design.

Finally, the storage system offers flexibility to customers by offering two different options, basket or tray solution, to allow a choice for how this system should be managed in both the OR and the sterilization department.



<b>55-981-09-04</b>	<b>L1® Rib basket set for instruments consisting of:</b>
55-981-01-04	L1® Rib instrument tray
55-981-02-04	L1® Rib insert 1
55-981-03-04	L1® Rib insert 2
55-981-79-04	Basket lid – full size



## KLS Martin Group

### **KLS Martin Australia Pty Ltd.**

Sydney · Australia  
Tel. +61 2 9439 5316  
australia@klsmartin.com

### **KLS Martin do Brasil Ltda.**

São Paulo · Brazil  
Tel. +55 11 3554 2299  
brazil@klsmartin.com

### **KLS Martin Medical (Shanghai) International Trading Co., Ltd**

Shanghai · China  
Tel. +86 21 5820 6251  
info@klsmartin.com

### **KLS Martin India Pvt Ltd.**

Chennai · India  
Tel. +91 44 66 442 300  
india@klsmartin.com

### **KLS Martin Italia S.r.l.**

Milan · Italy  
Tel. +39 039 605 67 31  
info@klsmartin.com

### **KLS Martin Japan K.K.**

Tokyo · Japan  
Tel. +81 3 3814 1431  
info@klsmartin.com

### **KLS Martin SE Asia Sdn. Bhd.**

Penang · Malaysia  
Tel. +604 261 7060  
malaysia@klsmartin.com

### **KLS Martin de México, S.A. de C.V.**

Mexico City · Mexico  
Tel. +52 55 7572 0944  
mexico@klsmartin.com

### **KLS Martin Nederland B.V.**

Huizen · Netherlands  
Tel. +31 35 523 45 38  
info@klsmartin.com

### **KLS Martin SE & Co. KG**

Moscow · Russia  
Tel. +7 499 792 76 19  
russia@klsmartin.com

### **KLS Martin Taiwan Ltd.**

Taipei · Taiwan  
Tel. +886 2 2325 3169  
taiwan@klsmartin.com

### **KLS Martin SE & Co. KG**

Dubai · United Arab Emirates  
Tel. +971 4 454 16 55  
middleeast@klsmartin.com

### **KLS Martin UK Ltd.**

Reading · United Kingdom  
Tel. +44 118 467 1500  
info.uk@klsmartin.com

### **KLS Martin LP**

Jacksonville · Florida, USA  
Tel. +1 904 641 77 46  
usa@.com

### **KLS Martin SE Asia Sdn. Bhd.**

Hanoi · Vietnam  
Tel. +49 7461 706-0  
vietnam@klsmartin.com



### **KLS Martin SE & Co. KG**

#### **A company of the KLS Martin Group**

KLS Martin Platz 1 · 78532 Tuttlingen · Germany  
PO Box 60 · 78501 Tuttlingen · Germany  
Tel. +49 7461 706-0 · Fax +49 7461 706-193  
info@klsmartin.com · www.klsmartin.com