

L1® Rib

Thoracic fixation system



Table of content

	Pages
Introduction	4 – 7
Product features	6 – 11
Fields of use and surgical technique	12 – 27
Treatment of a rib fracture	13 – 24
Implantation of special plates	25 – 27
Product range	28 – 43
■ Implants	28 – 35
Instruments	36 – 43
■ Storage	44 – 47



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) technologyy 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



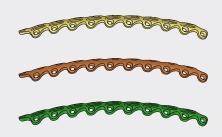
The L1® Rib system provides a large product range of plates that can be equipped with a sufficient number of locking screws in order to treat different patterns of injuries of the chest wall, including rib and rib serial fractures.

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 $L1^{\circ}$ 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



 Smart shape design based on average patient data

- Enables the same plates to be applied to any rib shape
- Decreasing inventory
- Improving overall system ease of use



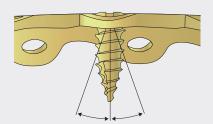
Special X-shape design with minimal footprint

- Allows for more screws per area of rib than conventional reconstruction plates
- Enables physical placement in a smaller segment of bone, smaller dissection or retraction area and easier precision in placement
- Frees up the rib for natural movement



Convergent biaxial fixation technology engages more bone

- Secure osteosynthesis is possible using monocortical screws
- Only one screw length required which simplifies the application and ease of use by eliminating the need of drilling and screw length measurement
- Helps to mitigate risk of harming soft tissue, increase operative efficiency and provide proper fixation for rib fractures



- ThreadLock TS multidirectional locking screw
- Drill-free screw

- Single pitch locking mechanism that allows for up to 20 degrees of angulation in any direction
- No need for pre-drilling
- No need for careful drilling, depth measurement and screw placement, which is required for traditional bicortical fixation

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



 Clear assignment while high compatibility of different instruments Interchangeability of instruments with clear focus on functionality



 Reduction forceps and plate holding forceps designed to suit the anatomy of the rib Easy, reliable reduction of the fracture

Unique shaped design of the working ends

 User-friendly handling allowing access to the ribs in all common approaches



 Drill guide for inserting screws in a predefined trajectory Proper fixation of the plate onto the rib

 Simple design and handling of the bending devices Easy adaptation of the plate curvature to the rib anatomy

Single-hand usage possible with most instruments

 Combination of surgical steps allows reduction of surgical time



■ Sizer available for all plates

■ Template reflects the plate 1-to-1

Easier bending of the sterile-packed plate

 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.

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 KLS Martin thoracic plating system is indicated for surgeries requiring osteosynthesis of the chest wall, and includes several plates that are used for the following indications:

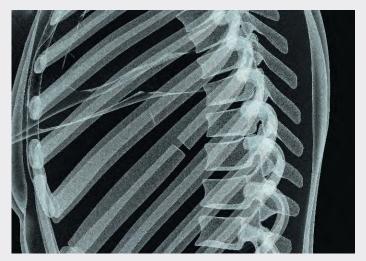
- L1® Rib plates are indicated for the osteosynthesis of rib fractures
- L1® Rib Y-plates are indicated for the osteosynthesis of rib fractures involving the sternum

For further information and a detailed description of the surgical techniques possible with the L1® Rib Y-plates please refer to the L1® Sternal brochure 91-350-86-02.



Surgical technique

Treatment of a rib fracture with L1® Rib plate and screws	Pages 16 – 26	
Implantation of special plates	Pages 27 – 29	



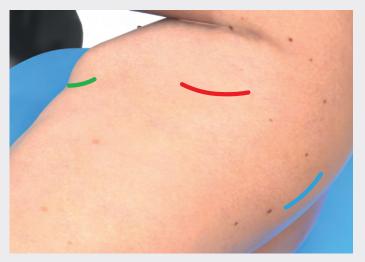


Preoperative planning

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.





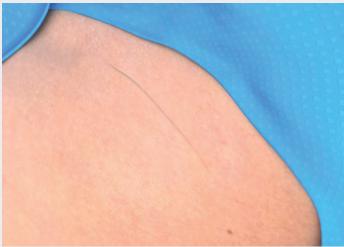
Positioning of the patient – paraspinal approach

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.

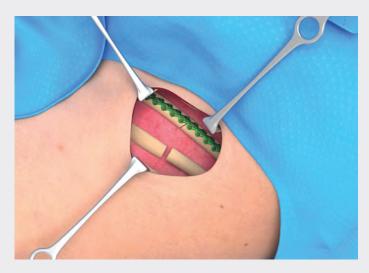




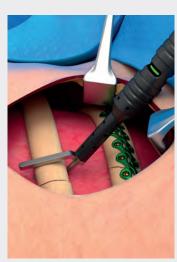
Positioning of the patient

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





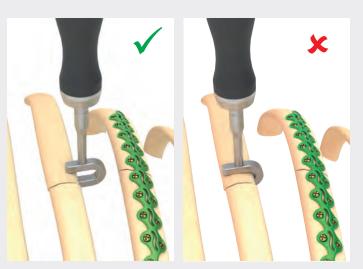


1. Expose the rib

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.

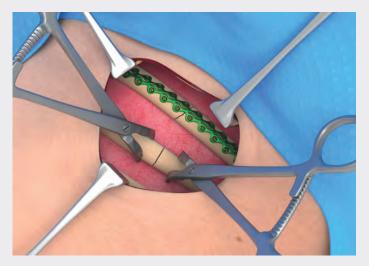
- Rib has adequate thickness.
- Caution: Use only with the CB3 screw guide.
- Do not use.

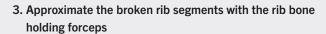


24-015-51-07 Fixed depth gauge

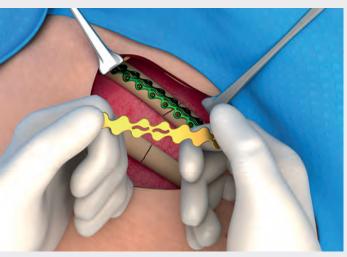


24-015-50-07 Tri color depth gauge





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:

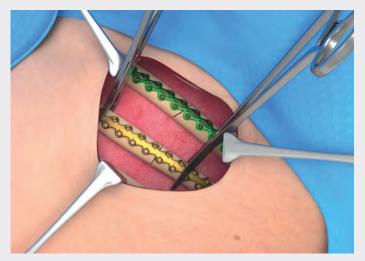
If contouring is necessary, avoid sharp bends, reverse bends, or bending the implant at a screw hole. Avoid notching or scratching the implant. These factors may produce internal stresses which may become the focal point for eventual breakage of the implant.

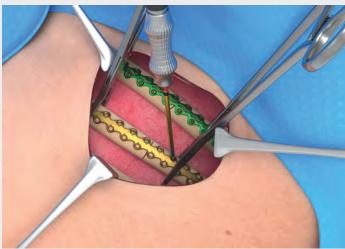


22-523-22-07 Double action plate cutter



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.

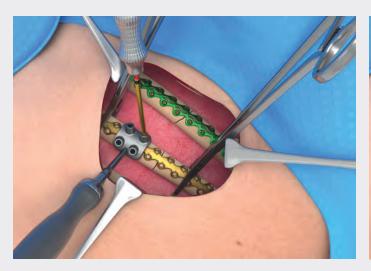


Long straight plate

holding forceps



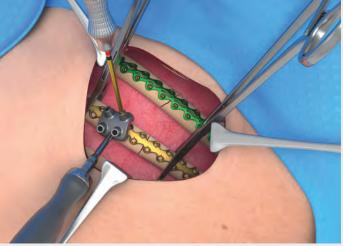
24-015-66-07 Short straight plate holding forceps



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

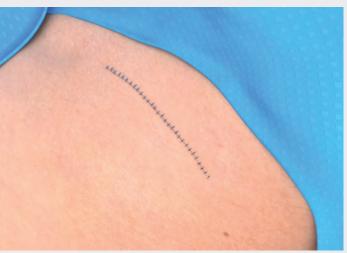


25-486-97-07 Screwdriver blade





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



10. Wound closure and post operative treatment

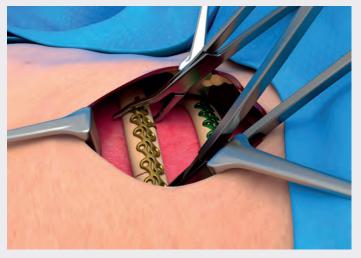
Close the wound according toyour surgical preference.

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

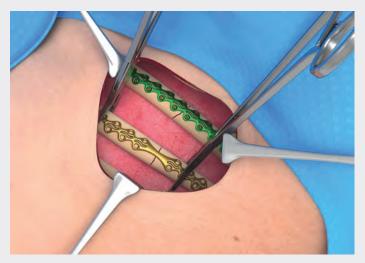
When using the tabbed plate, the surgeon must not bend the tabs in a back and forth motion as this may weaken the tabs, causing them to fracture. Avoid unnecessary bending.

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

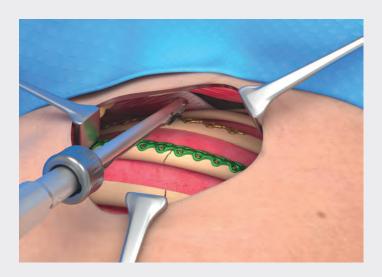
When using the spar plate, the surgeon must ensure the spar is aligned over the fracture site and that a minimum of three screws are placed on each side of the fracture. Failure to align the plate properly may result in inadequate fixation of the fracture.

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 reommended 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 2 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 2 screwdriver

Position the plate on the rib over the fracture, allowing a minimum of three screws on each side of the fracture.

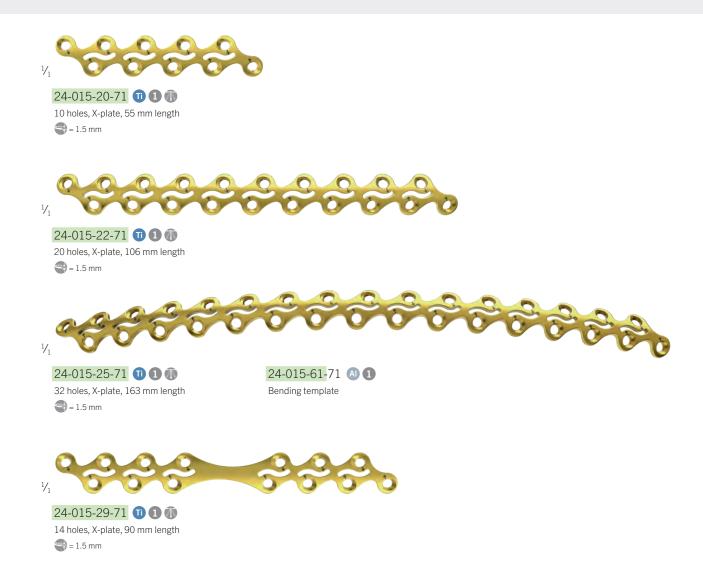
Verify that the contour of the plate matches the rib. The plate holding forceps are specially designed to hold the plate on the rib. Proceed to step 8 for screw placement instructions.





50-990-00-07 Angulus 2 angled screwdriver

Implants L1® Rib — maleable plates in profile thickness 1.5 mm





Explanation of icons

Ti CP Titanium



Quantity / units per package



Multidirectional locking screw hole



Plate profile



Aluminum

STERILE R Sterile



24-015-30-71 11 11



14 holes, universal straight, 103 mm length

= 1.5 mm



24-015-31-71 11 11

16 holes, tabbed plate, 85 mm length

= 1.5 mm



24-015-32-71 11 1



16 holes, solid plate, 85 mm length

= 1.5 mm



24-015-35-71 1 1

20 holes, solid plate, 102 mm length

= 1.5 mm

Implants **L1**® Rib — semi rigid plates in profile thickness 1.5 mm





Explanation of icons



Ti CP Titanium



Quantity / units per package



Multidirectional locking screw hole



STERILE R Sterile



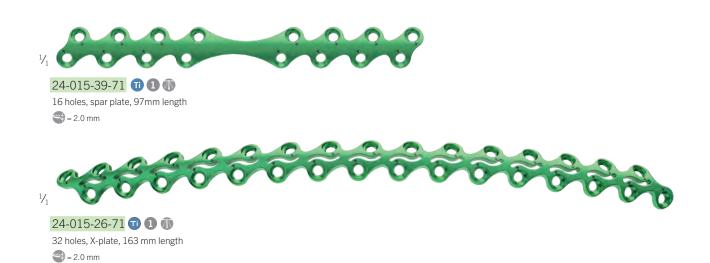
24-015-49-71 11 1 16 holes, spar plate, 97 mm length

= 1.5 mm

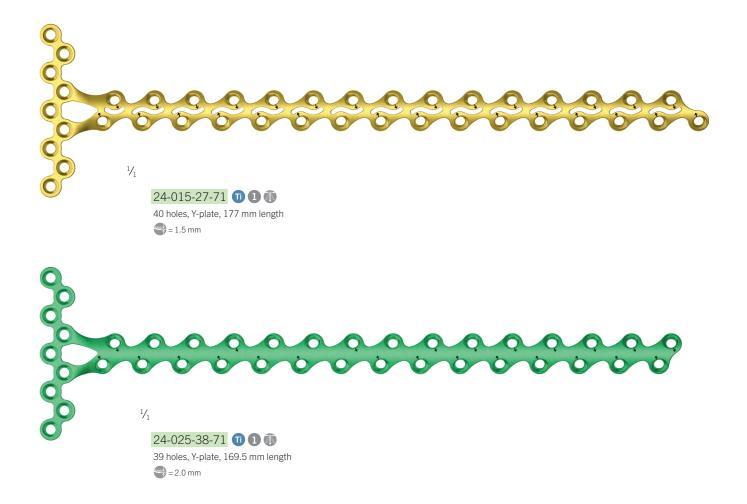
Implants **L1**® Rib — rigid plates in profile thickness 2.0 mm







Implants **L1**® Rib — Y-plates in profile thickness 1.5 and 2.0 mm

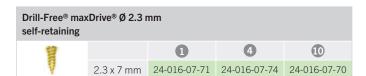






For further information and a detailed description of the surgical techniques possible with the L1 $^{\circ}$ Rib Y-plates please refer to the L1 $^{\circ}$ Sternal brochure 91-350-86-02.

Implants and instruments **L1**® Rib maxDrive® screws and screwdrivers









25-407-03-04 Screwdriver handle silicone



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

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

St 1





50-800-02-71

Battery pack for 50-800-04-07

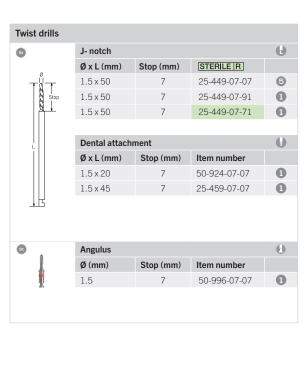


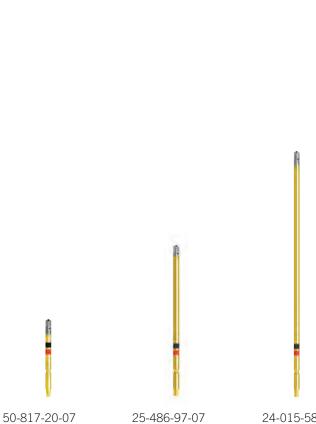












maxDrive® blade 2.0/2.3

maxDrive® blade 2.0/2.3

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



Instruments **L1**® Rib – repositioning instruments





Instruments **L1**® Rib — osteosynthesis instruments







Instruments L1® Rib plate holding instruments



24-015-72-07

21.5 cm, 8 ½"

Rib plate holding forceps, press style, with hinge





24-015-69-07

19 cm, 7"

Rib plate holding forceps, press style





24-015-53-07

17.7 cm, 7"

Rib plate holding forceps, long, straight





24-015-53-07

17.7 cm, 7"

Rib plate holding forceps, long, straight







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.



55-981-09-04	L1® Rib basket set for instruments consisting of:
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







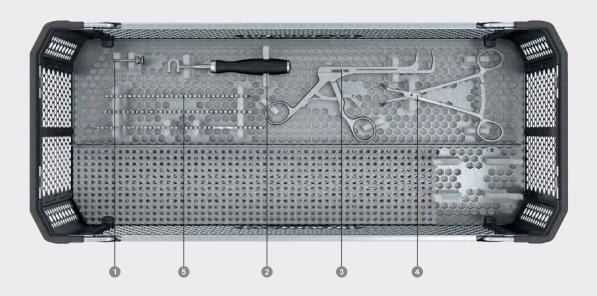
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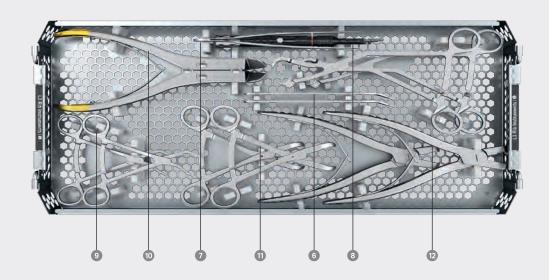
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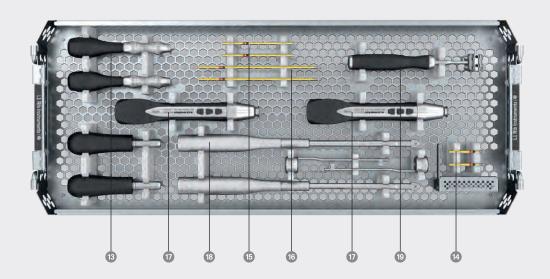
55-981-79-04



Arrangement of the instruments — L1® Rib instrument tray					
0		1	Deburrer		
2	1 - 24-015-51-07	1	Fixed depth gauge		
3	2 - 24-015-71-07	1	Rip plate holding forceps, vertical		
4	3 - 24-015-70-07	1	Rip grasping forceps		
5	4 - 24-015-63-09	1	Implant sizer set		



Arrangement of the instruments – L1® Rib insert 1					
6	1 - 23-539-15-07	2	Bone lever		
7	2 - 12-188-17-07	1	Cushing forceps, serrated		
8	3 - 24-015-50-07	1	Tri-color depth gauge		
9	4 - 24-015-54-07	2	Rib bone holding forceps, press style		
10	5 - 24-015-62-07	1	Large bending pliers		
1	6 - 24-015-66-07	2	Rib plate holding forceps, narrow tip		
12	7 - 24-015-72-07	2	Rib plate holding forceps, press style, with hinge		



Arrangement of the instruments — L1® Rib insert 2					
13	5 - 25-407-03-04	2	Screwdriver handle silicone		
14	6 - 50-817-20-07	2	maxDrive® blade 2.0/2.3, 40 mm		
15	7 - 25-486-97-07	2	maxDrive® blade 2.0/2.3, 80 mm		
16	8 - 24-015-58-07	2	maxDrive® blade 2.0/2.3, 130 mm		
17	9 - 50-800-04-07	2	BOS driver "HT" (without battery pack)		
18	10 - 50-990-00-07	2	Angulus 2 angled screwdriver with handle		
19	11 - 24-015-59-07	1	CB3 screw guide		

KLS Martin Group

KLS Martin Australia Pty Ltd.

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

KLS Martin Italia S.r.l.

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

KLS Martin Nederland B.V.

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

KLS Martin UK Ltd.

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

KLS Martin do Brasil Ltda.

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

KLS Martin Japan K.K.

Tokyo · Japan Tel. +81 3 6410 8471 japan@klsmartin.com

KLS Martin SE & Co. KG

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

KLS Martin LP

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

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

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

KLS Martin SE Asia Sdn. Bhd.

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

KLS Martin Taiwan Ltd.

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

KLS Martin SE Asia Sdn. Bhd.

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

KLS Martin India Pvt Ltd.

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

KLS Martin de México, S.A. de C.V.

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

KLS Martin SE & Co. KG

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



KLS Martin SE & Co. KG A company of the KLS Martin Group

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