

MatrixRIB™

Fixation System

Surgical Technique

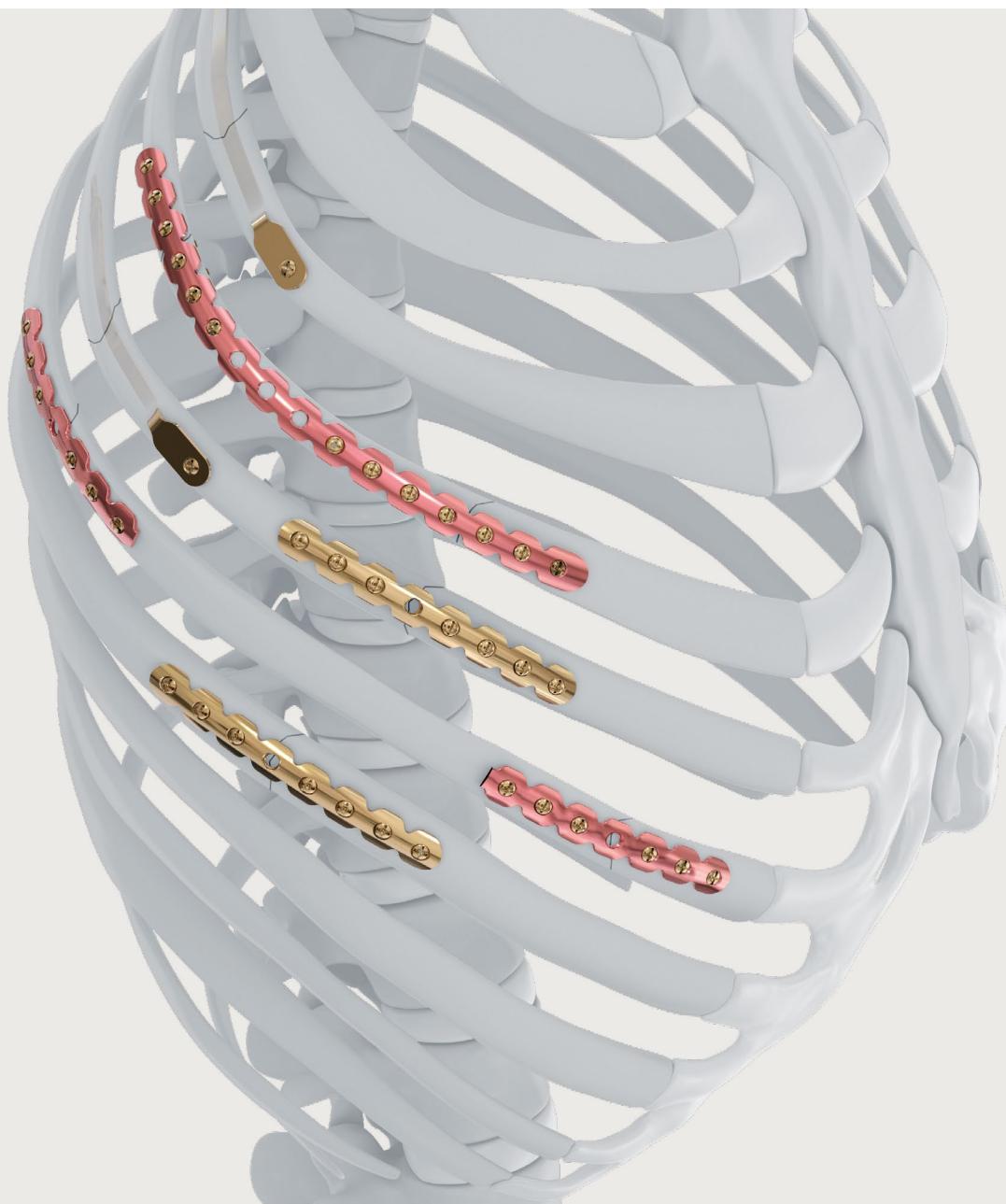


 Image intensifier control

This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

Processing, Reprocessing, Care and Maintenance

For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to: <https://ifu.depuysynthes.com> and/or www.e-ifu.com

For general information about reprocessing, care and maintenance of DePuy Synthes reusable devices, instrument trays and cases, as well as processing of DePuy Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to: <https://ifu.depuysynthes.com> and/or www.e-ifu.com

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Introduction

Background

Rib fractures

Rib fractures are common in blunt chest wall trauma. Although fractured ribs usually heal on their own without specific treatment, a subset of patients have fractures that produce overlying bone fragments that may produce severe pain, respiratory compromise, and chest wall deformity.

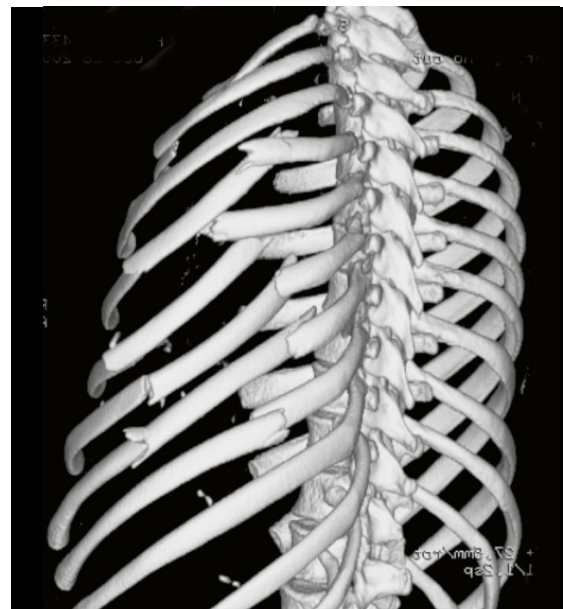
Most of the fractured ribs are treated with conservative nonoperative care. These include aggressive pain management (epidural analgesia, rib oral analgesics and/or bracing techniques), and ventilation and tracheotomy¹ until fibrous stabilization is achieved. These treatment methods have been shown to have good results in respect to restoration of the damaged chest wall, but have higher chest infection and mortality rates compared to surgical treatment.^{2,3}

More severe chest wall trauma is a major cause of morbidity and mortality, especially in the presence of a flail chest where paradoxical inward movement of the flail segment in inspiration is found. Patients with flail chest often require aggressive pain control, ventilation, and prolonged ICU stay.¹

About 10% of chest wall trauma cases result in a flail chest.⁴ Flail chest injuries, defined as fracture of at least three consecutive ribs in at least two locations each, are associated with a mortality rate of up to 36%.^{4,5} Flail chest injuries develop paradoxical inward movement of the flail segment which prevents effective inspiration and requires prolonged mechanical ventilation which can lead to pneumonia and sepsis.⁴

The need to improve rib fracture treatment has been recognized for many years and some surgeons have been using operative approaches including plates, intramedullary devices, vertical bridging, wire, sutures, and struts to repair the chest wall.²⁻¹⁰

These attempts indicate a trend in better rib fracture treatment to improve pain control, reduce duration of mechanical ventilation, reduce ICU stays, reduce the risk for chest wall deformities, and ultimately improve patient care.

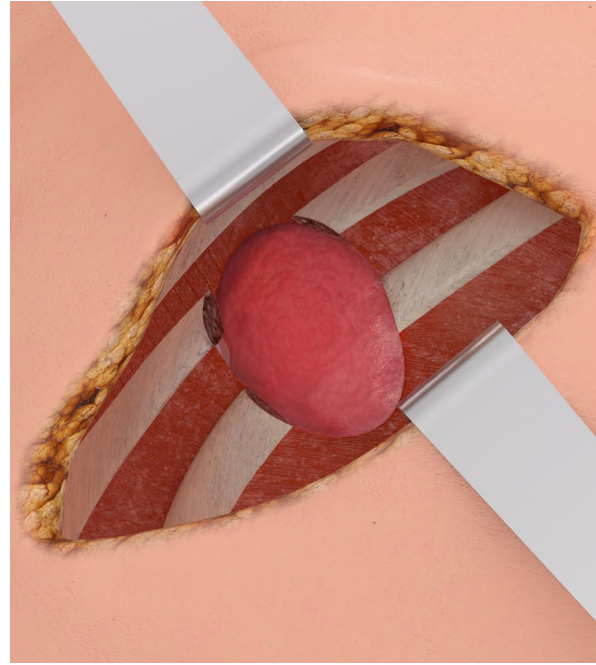


CT image of flail chest. Image courtesy of Mario G. Gasparri, MD, Medical College of Wisconsin.

Introduction

Chest wall resection

Large resections of the chest wall, including the ribs, sternum, and/or surrounding soft tissue, are performed for the curative and palliative treatment of malignant and benign tumors, radiation necrosis, and deep sternal wound infections. Resections of defects greater than 5 cm in diameter require skeletal reconstruction to maintain physiologic respiratory function and protect vital intrathoracic organs.¹¹ Flail chest and paradoxical respiration may occur without proper stabilization causing pain, respiratory distress, and often necessitating long-term mechanical ventilation. The main goals of reconstruction are: prevention of flail chest, maintenance of physiologic respiration, protection of thoracic organs, and an acceptable cosmetic result.¹¹



Example of chest wall resection

MatrixRIB™ Fixation System

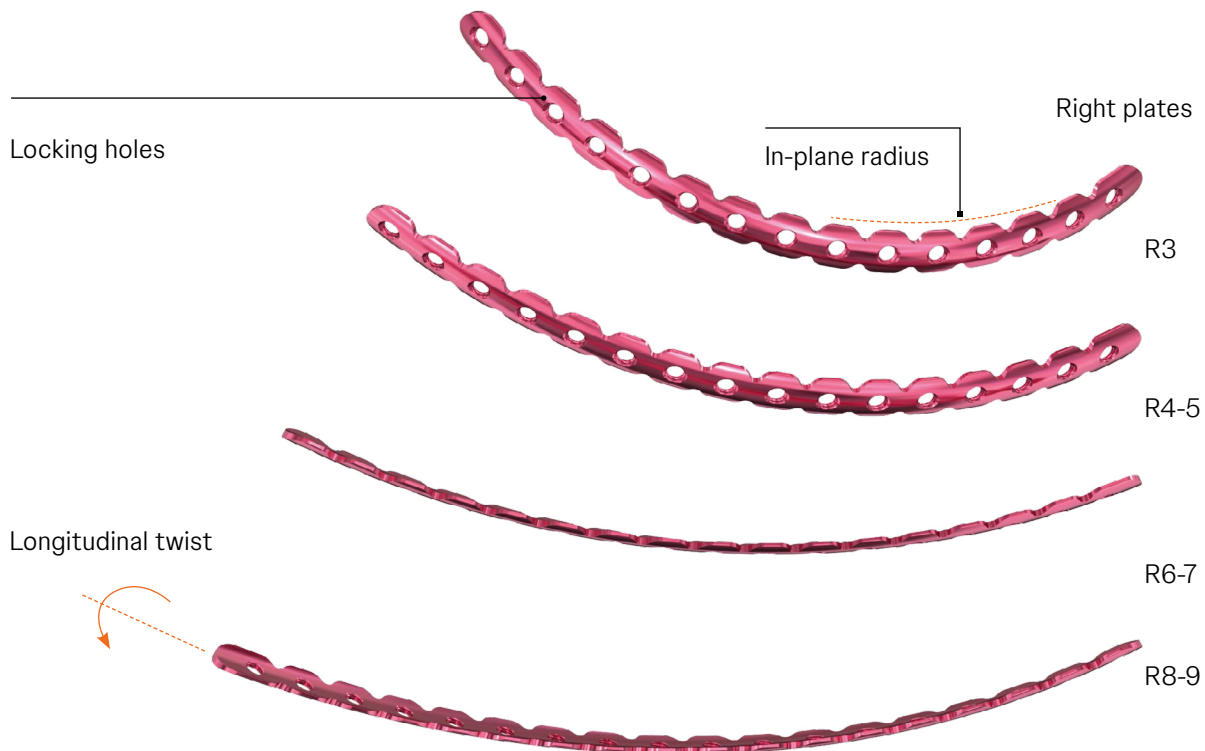
Overview

The DePuy Synthes CMF MatrixRIB™ Fixation System consists of precontoured, shaped, and straight locking plates, locking screws, and intramedullary splints.

- Used without removing periosteum
- Drill bit with stop to prevent over-drilling
- Self-retaining screwdriver blades

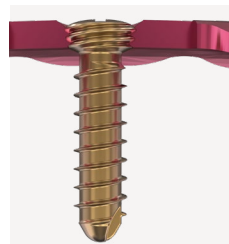
Precontoured plates

- Precontoured
- Low profile, 1.5 mm thick
- Color coded to distinguish left and right designs
- Etched on medial end to indicate the corresponding rib curvature



Intramedullary splints

- Three widths available (3 mm, 4 mm, 5 mm)
- One screw needed to secure splint



Self-tapping Locking Screw.

Requires pre-drilling. Does not require tapping.



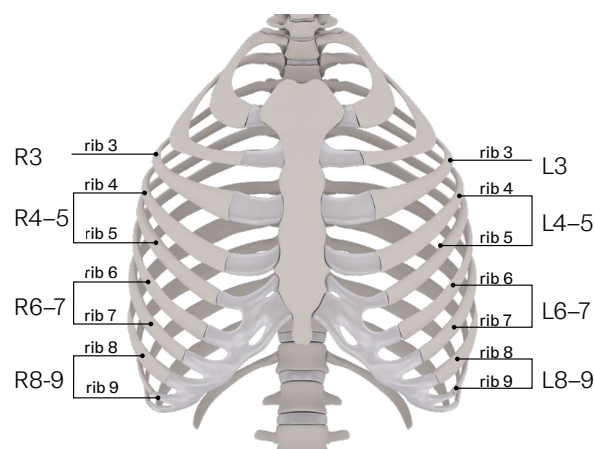
Self-drilling Locking Screw.

Does not require pre-drilling or tapping.

Locking screws

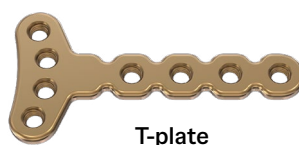
- Screws work with self-retaining screwdriver blades

MatrixRIB™ Fixation System

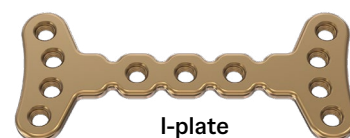


Sternal body plates

- 2.8 mm thickness



T-plate

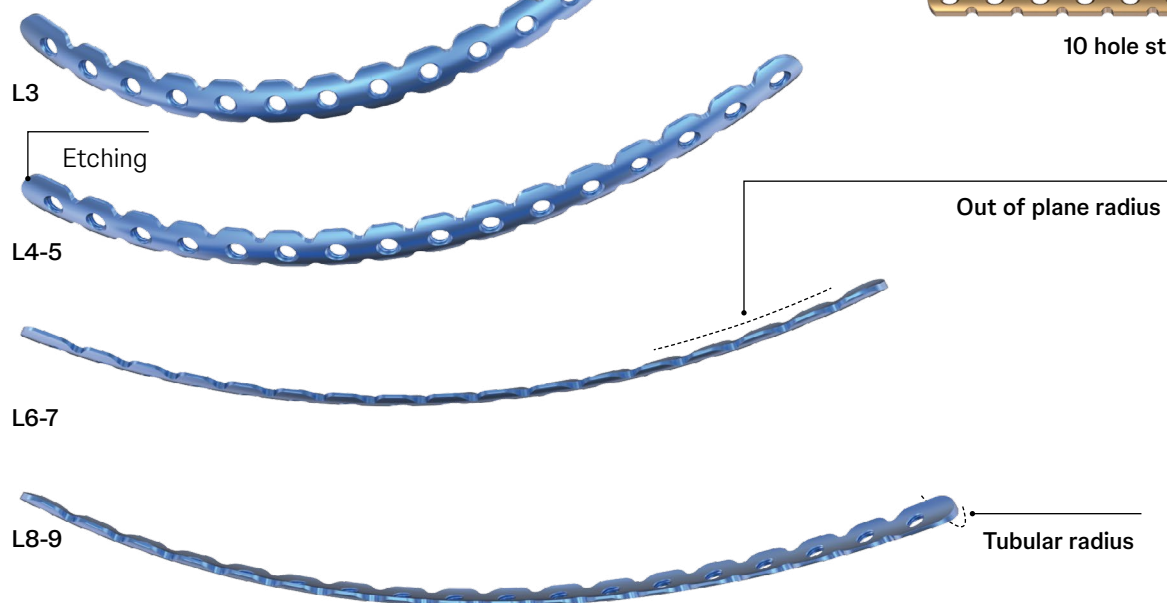


I-plate



10 hole straight

Left plates



Universal/Straight plates

- Universal plate – 8 holes
- Straight plates – 24 or 30 holes



Universal plate, 8 holes



24 holes



30 holes

Warnings

General Warnings

- Metallic internal fixation devices cannot withstand activity levels and/or loads equal to those placed on normal healthy bone as these devices are not designed to withstand the unsupported stress of full weightbearing, load-bearing, or gap spanning which may result in fatigue failure of the device.
- Additionally, using the device for spanning gaps in patients that put extreme strain on the implant (e.g. overweight or non-compliant) may further contribute to premature device failure.
- These devices can break intraoperatively when subjected to excessive forces or outside the recommended surgical technique. While the surgeon must make the final decision on removal of the broken part based on associated risk in doing so, we recommend that whenever possible and practical for the individual patient, the broken part should be removed.
- Medical devices containing stainless steel may elicit an allergic reaction in patients with hypersensitivity to nickel.
- The MatrixRIB Fixation System is not intended for use as a permanent implant for bridging gaps after chest wall resections.

Please refer to the corresponding Instructions for Use for specific information on Intended use, Indications, Contraindications, Warnings and Precautions, Potential Adverse Events, Undesirable Side Effects and Residual Risks. Instructions for Use are available at www.e-ifu.com and/or www.depuysynthes.com/ifu

MRI Information on Torque, Displacement, Image Artifacts and Radio Frequency (RF)-induced heating can be found in the corresponding system Instructions for Use.

Suggested* clinical applications

Suggested* clinical applications for the MatrixRIB Fixation System

Application	Pre-contoured plates (1.5 mm) 	Universal plate (1.5 mm) 	Straight plates (1.5 mm) 	Sternal plates (2.8 mm) 	Intramedullary splints (1.0 mm) 
Trauma					
Rib fracture	✓	✓	✓		✓
Sternal fracture			✓	✓	
Thoracotomy					
Rib osteotomy/iatrogenic fracture	✓	✓	✓		✓
Transverse sternotomy				✓	
Chest wall reconstruction					
Rib reconstruction/resections	✓		✓		
Sternal reconstruction/resections			✓		
Chest wall deformity repair					
Transverse sternotomy				✓	
Rib osteotomy	✓	✓	✓		✓

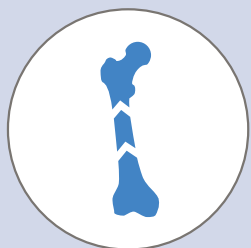
* Selection of plates should be based on individual patient anatomy, severity of injury/deformity, and surgeon preference.

The AO principles of fracture management

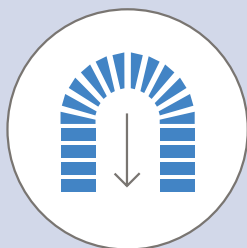
Mission

The AO's mission is promoting excellence in patient care and outcomes in trauma and musculoskeletal disorders.

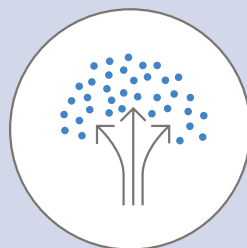
AO principles^{1,2}



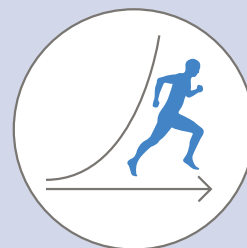
Fracture reduction and fixation to restore anatomical relationships.



Fracture fixation providing absolute or relative stability, as required by the “personality” of the fracture, the patient, and the injury.



Preservation of the blood supply to soft-tissues and bone by gentle reduction techniques and careful handling.



Early and safe mobilization and rehabilitation of the injured part and the patient as a whole.

1. Müller ME, Allgöwer M, Schneider R, Willenegger H. Manual of Internal Fixation. 3rd ed. Berlin, Heidelberg New York: Springer 1991.

2 Buckley RE, Moran CG, Apivatthakakul T. AO Principles of Fracture Management: 3rd ed. Vol. 1: Principles, Vol. 2: Specific fractures. Thieme; 2017.

Rib plating technique

Plating rib

1. Expose rib

Expose the rib to allow a minimum of three screws on each side of the fracture.

Remove any nonviable bone.

Precaution

- Avoid significant muscle division to preserve as much respiratory function as possible.

Note

- Removal of the periosteum is not required.



Rib plating technique

2. Measure rib thickness

Instrument

03.501.074 Universal Caliper

Optional instrument

03.501.065 Caliper

Make a small incision in the intercostal space at the superior border of the rib to allow insertion of the caliper tip. Insert the caliper tip through the incision and measure the rib thickness.

Note

- If an existing access into the intercostal space is available for measuring the rib thickness, it is recommended to insert the caliper tip using the existing access.

To select the appropriate drill bit with stop and the appropriate screw length, add 2 mm to the measurement to allow for the plate thickness.

If the bone is measured with the plate in place, do not add 2 mm.

Precaution

- Take care to avoid damaging the nerve and vessel bundle at the inferior border of the rib.



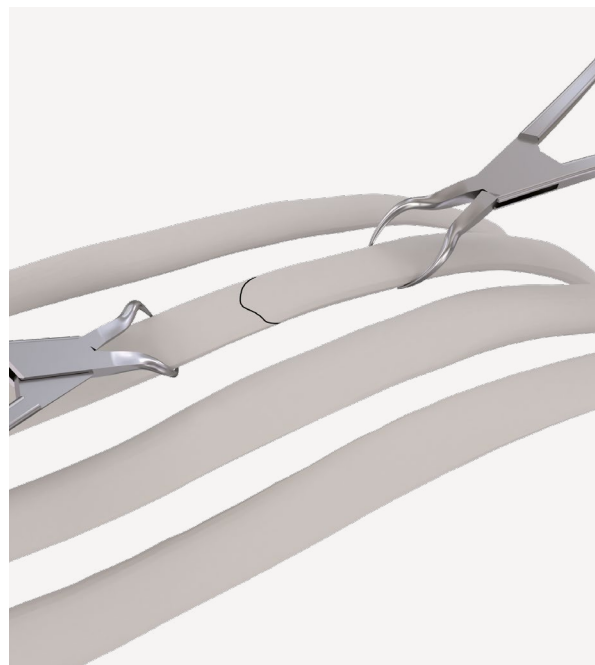
Rib plating technique

3. Approximate broken rib segments

Instrument

398.400 Reduction Forceps with points, narrow, ratchet,
132 mm length

Use the forceps to approximate the broken rib segments.



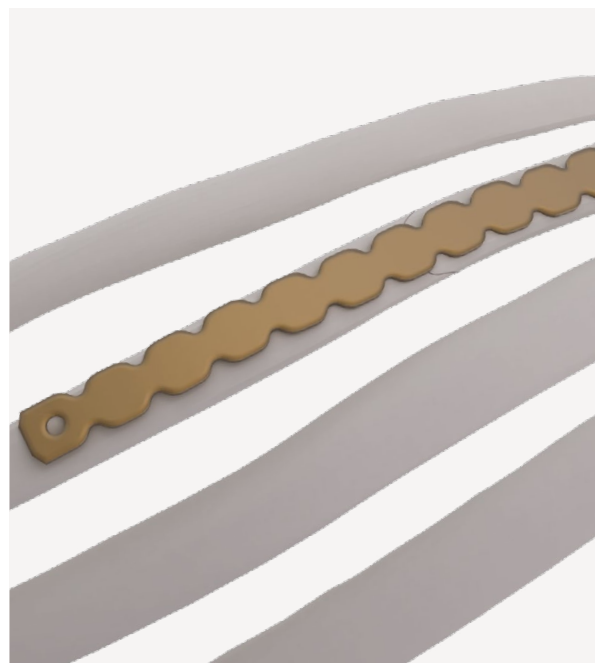
4. Cut and contour plate template (optional)

Instrument

03.501.090 Bending Template for MatrixRIB
Locking Plates, 300 mm length

Cut the bending template to a length that allows placement of a minimum of three screws on each side of the fracture.

Contour the template to the rib.



Rib plating technique

5. Select and cut plate (optional)

Instrument

03.503.057 Short Cut Plate Cutter (2 required)

Use the plate template contoured in Step 4 to select the best matching plate.

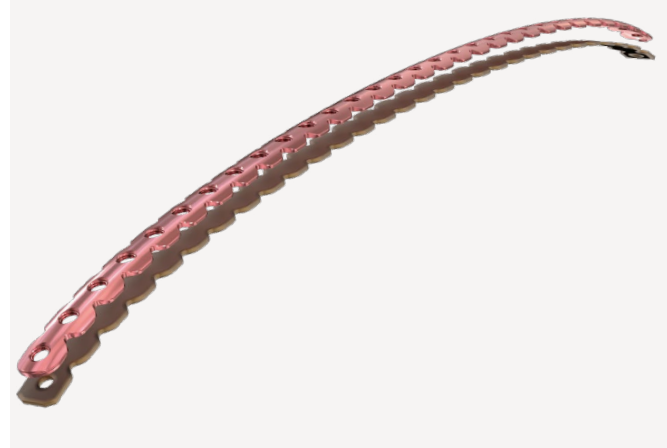
■ Notes

- Position the precontoured plate with the marking toward the sternum
- Straight plates are available for use in place of a precontoured plate (see section “Implants”)

If necessary, cut the plate to the desired length.

⚠ Precaution

- Use a minimum of three screws on each side of the fracture, to properly secure the plate.



Rib plating technique

6. Contour plate (optional)

Instrument

03.501.091 Combination Bending Pliers for MatrixRIB

Using the bending pliers, contour the plate to match the template.

Precaution

- 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.



Rib plating technique

7. Position plate

Instrument

03.501.071 MatrixRIB Plate Holding Forceps, small

Optional instruments

03.501.030 MatrixRIB Plate Holding Forceps, small, with ball tips

03.501.031 MatrixRIB Plate Holding Forceps, large, with ball tips

03.501.704 Threaded Reduction Tool for MatrixRIB System, AO Quick Coupling (see section “Threaded reduction tool instructions”)

03.501.708 MatrixRIB Plate Holding Forceps, upright with ball tip

03.501.709 MatrixRIB Plate Holding Forceps, large

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. Using the plate holding forceps, hold the plate on the rib.

Precaution

- 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.



Rib plating technique

8. Drill

Instruments

03.501.033	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates
03.501.036–	MatrixRIB Drill Bit Ø 2.2 mm with Stop, length 135/6 mm
03.501.050	to length 135/20 mm, for J-Latch Coupling

Optional instruments

03.501.700	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long
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Thread the drill guide into the plate. This will help facilitate safe drilling and alignment of the drill hole with the plate hole.

Select the drill bit with stop as determined in Step 2 and drill.

Drill bits with stop are available with stop lengths ranging from 6 mm to 20 mm, in 2 mm increments, matching the locking screw lengths.

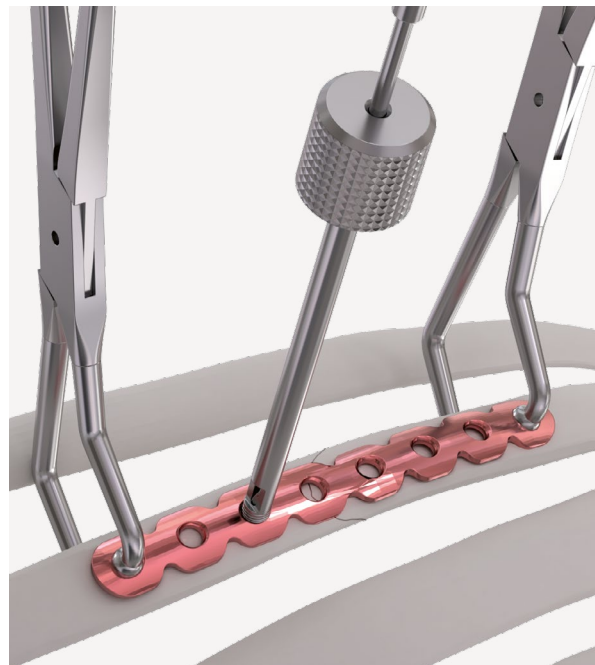
⚠ Precautions

- Irrigate during drilling to avoid thermal damage to the bone.
- Do not drill any deeper than necessary, to avoid the risk of pneumothorax.
- Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.

Remove the 2.2 mm drill guide after drilling.

Options

- The Trocar Instrumentation for MatrixRIB Fixation System may be used for drilling (see section “Trocar instruments instructions for MatrixRIB Fixation System”).
- The 90° Screwdriver for MatrixRIB Fixation System may be used for drilling (see section “90° Screwdriver instructions for MatrixRIB Fixation System”).



Rib plating technique

9. Confirm rib thickness (optional)

Instruments

03.503.085 Depth Gauge for 2.0 mm to 3.0 mm screws with polymer handle

Optional instrument

03.501.001 Depth Gauge for 2.7 mm and larger screws with zero offset

Use the depth gauge through the plate to confirm the appropriate screw length determined in Step 2.

Precaution

- Do not extend the tip of the depth gauge too far beyond the posterior cortex of the rib.

Note

- When using the cannula, the 03.503.085 depth gauge must be used.



Rib plating technique

10. Select and insert screw

Instruments

03.503.071	MatrixMANDIBLE™ / THORAX Self-Retaining Screwdriver Blade, medium
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311.023	Ratcheting Screwdriver Handle
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Optional instrument

03.503.072	MatrixMANDIBLE™ / THORAX Self-Retaining Screwdriver Blade, long
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Select and insert the locking screw (with proper length determined in Step 2) through the plate and tighten until secure.

Screws can be measured using the screw length indicator on the module

⚠ Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- In order to determine the appropriate amount of fixation for stability, the surgeon should consider the size and shape of the fracture or osteotomy. The manufacturer recommends at least three screws per plate per fracture side when repairing osteotomies and fractures with this system. Additional fixation is recommended to ensure stability of large fractures and osteotomies.
- The non-locking screws are for temporary fixation and will need to be replaced with locking screws before closure.



Rib plating technique

Options

- The Trocar Instrumentation for MatrixRIB Fixation System may be used for screw insertion (see section “Trocar instruments instructions for MatrixRIB Fixation System”).
- The 90° Screwdriver for MatrixRIB Fixation System may be used for screw insertion (see section “90° Screwdriver instructions for MatrixRIB Fixation System”).
- 10 and 12 mm non-locking screws are available to facilitate the plate to sit flush with the bone.
- Self-drilling screws may be used as an alternative to self-tapping screws (see section “Self-drilling screws technique for 1.5 mm MatrixRIB Plates”).

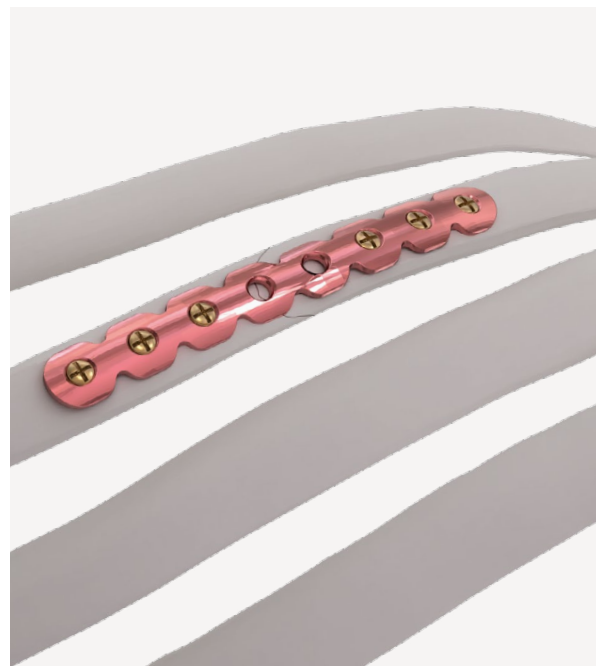
11. Drill and place remaining screws

Verify proper reduction of the fracture.

Insert a second screw on the opposite side of the fracture following Steps 8 and 10. Insert remaining screws in the same manner.

Precautions

- If non-locking screws are not replaced with locking screws, the likelihood of implant loosening/migration may be increased.
- Use a minimum of three screws on each side of the fracture, to properly secure the plate.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.



Splint insertion technique

Splint insertion

The intramedullary splints have a rectangular profile and a locking feature to limit migration and rotation of the implant.

Intramedullary splints

- Three widths available (3 mm, 4 mm, 5 mm)
- One screw needed to secure splint



1. Expose rib

Expose the rib to allow splint head placement. A minimum of 50 mm on the medial side of the fracture is recommended.

Remove any nonviable bone.

⚠ Precautions

- It is recommended to minimize the dissection of the soft tissue on the lateral side of the fracture
- Avoid significant muscle division to preserve as much respiratory function as possible.

■ Note

- Removal of the periosteum is not required.

Splint insertion technique

2. Measure rib thickness

Instrument

03.501.074 Universal Caliper

Optional instrument

03.501.065 Caliper

Make a small incision in the intercostal space at the superior border of the rib to allow insertion of the caliper tip.

Insert the caliper tip through the incision and measure the rib thickness.

Note

- If an existing access into the intercostal space is available for measuring the rib thickness, it is recommended to insert the caliper tip using the existing access.

To select the appropriate drill bit with stop and the appropriate screw, add 1 mm to the measurement to allow for the splint thickness.

Precaution

- Take care to avoid damaging the nerve and vessel bundle at the inferior border of the rib.



Splint insertion technique

3. Prepare splint insertion hole

Instruments

03.501.055	5.5 mm Drill Guide for MatrixRIB Intramedullary Splints
03.501.070	MatrixRIB Drill Bit Ø 5.5 mm with Stop, length 125 mm, 2-flute, for J-Latch Coupling
03.501.071	MatrixRIB Plate Holding Forceps, small

Optional instruments

03.501.032	MatrixRIB Intramedullary Splint Driver
03.501.075	5.5 mm Drill Guide for MatrixRIB Intramedullary Splints, without handle

Insert the hook end of the drill guide into the intramedullary canal of the medial segment until it is seated fully on the rib.

■ Notes

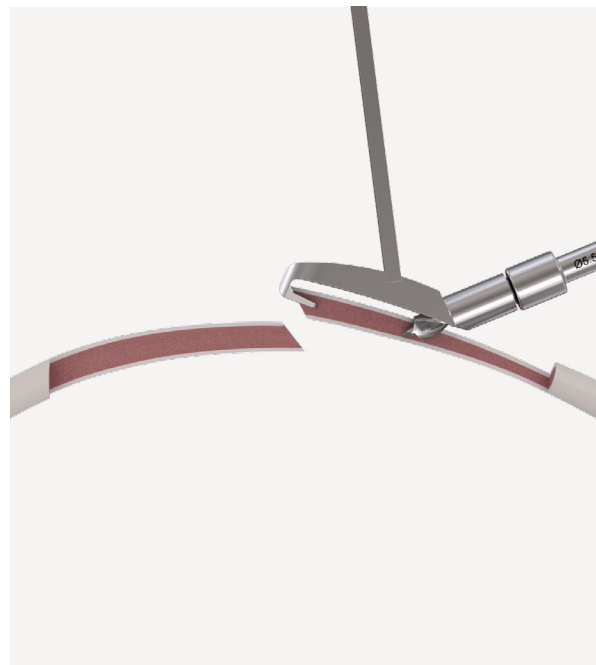
- It is recommended to insert the hook near the superior edge of the rib, and to drill an entry hole in the upper 2/3 of the rib
- The small plate holding forceps can be used to hold the drill guide against the rib during drilling

⚠ Precautions

- If the drill guide without handle is used, ensure the tapered end, labeled “Fracture,” is aligned with the fracture to ensure the hole is approximately 30 mm from the fracture line.
- Ensure the lateral fracture segment is at least 5 cm long to accommodate the insertion length of the splint before drilling.

■ Note

- The splint driver may be threaded into the drill guide to act as a handle, as needed.



Splint insertion technique

Ensure the medial end of the drill guide contacts the bone.

Using the 5.5 mm drill bit with stop, drill monocortically.

Precautions

- **Irrigate during drilling to avoid thermal damage to the bone.**
- **Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.**

Remove the drill guide and verify the hole is approximately 30 mm from the fracture line.

Splint insertion technique

4. Select splint

Instruments

03.501.032	MatrixRIB Intramedullary Splint Driver
03.501.061	MatrixRIB Intramedullary Splint Template, small
03.501.062	MatrixRIB Intramedullary Splint Template, medium
03.501.066	Mallet, 200 g
398.400	Reduction Forceps with points, narrow, ratchet, 132 mm length

The splint template is used to prepare the canal and select the correct size of splint. It is recommended to start with the small template before using the medium template.

Thread the splint driver into the splint template and insert the template into the insertion hole prepared in Step 3.

Remove the splint template.

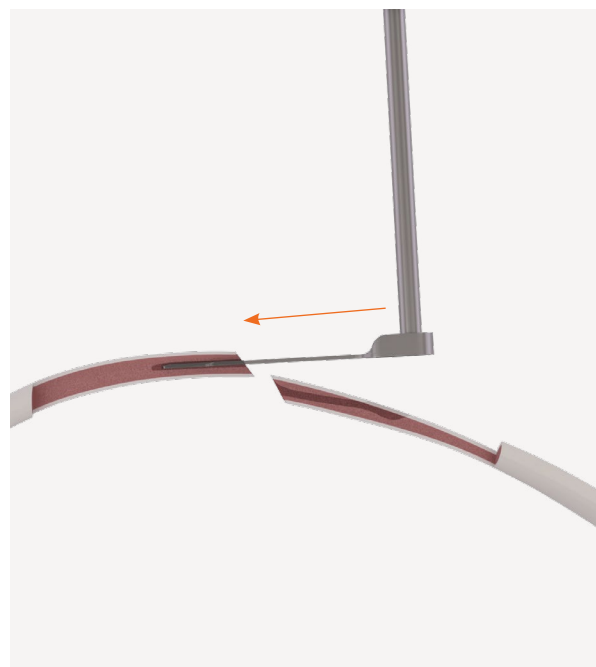
Fully insert the template into the canal of the lateral fracture segment.

Remove the splint template.

■ Notes

- If the small template fits snugly, use the 3 mm wide splint.
- If the medium template fits snugly, use the 4 mm wide splint.
- If the medium template fits loosely, use the 5 mm wide splint.
- Use the mallet to assist insertion of the splint template, if needed.

Use bone reduction forceps to hold the rib segment during splint template insertion.



Splint insertion technique

5. Insert splint

Instruments

03.501.032	MatrixRIB Intramedullary Splint Driver
03.501.066	Mallet, 200 g
398.400	Reduction Forceps with points, narrow, ratchet, 132 mm length

Thread the splint driver into the splint selected in Step 4, with the splint marking facing up toward the handle.

Insert the splint through the insertion hole prepared in Step 3.

Drive the splint across the fracture line and into the canal of the lateral segment. The splint is fully inserted when the head of the splint rests flush on the outside of the rib.

Remove the splint driver after the splint is fully seated.

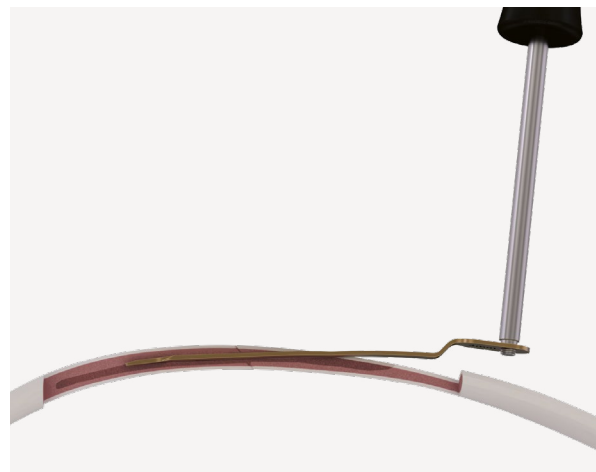
⚠ Precautions

To prevent additional injuries to the rib, spine, and/or underlying organs:

- Avoid any steep angle during splint insertion to prevent damage of the posterior cortex of the rib.
- Do not insert the splint head further once it is seated in the insertion hole.

■ Note

- The mallet can be used to assist insertion of the splint, if needed.



Splint insertion technique

6. Drill screw hole

Instruments

03.501.033	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates
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03.501.036– 03.501.050	MatrixRIB Drill Bit Ø 2.2 mm with Stop, length 135/6 mm to length 135/20 mm, for J-Latch Coupling
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Optional instrument

03.501.700	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long
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03.501.071	MatrixRIB Plate Holding Forceps, small
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Thread the drill guide into the splint.

Note

- **Plate holding forceps may be used to hold splint head flush to bone during drilling.**

Select the drill bit with stop as determined in Step 2 and drill.

Drill bits with stop are available with stop lengths ranging from 6 mm to 20 mm, in 2 mm increments, matching the locking screw lengths.

Precautions

- **Irrigate during drilling to avoid thermal damage to the bone.**
- **Do not drill any deeper than necessary to avoid the risk of pneumothorax.**
- **Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.**

Remove the 2.2 mm drill guide after drilling.



Optional method

Splint insertion technique

7. Confirm rib thickness (optional)

Instrument

03.501.001 Depth Gauge for Sternal Cable

Optional instruments

03.503.085 Depth Gauge for MatrixMANDIBLE™,
measuring range up to 40 mm

Use the depth gauge through the splint to confirm the screw length determined in Step 2.

Precaution

- Do not extend the tip of the depth gauge too far beyond the posterior cortex of the rib.

Splint insertion technique

8. Select and insert screw

Instruments

03.503.071	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, medium
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311.023	Ratcheting Screwdriver Handle
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Optional instrument

03.503.072	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, long
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Select and insert the locking screw (with proper length determined in Step 2) through the splint and tighten until secure.

Screws can be measured using the screw length indicator on the module.

⚠ Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.

Option

- Self-drilling screws may be used as an alternative to self-tapping screws. (See section “Self-drilling screws for intramedullary splints”)



Sternal plating technique

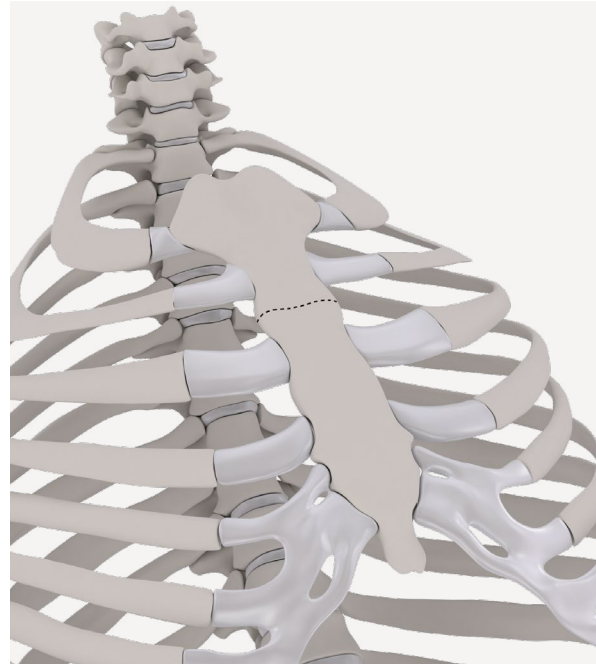
Plating sternum

1. Exposed fracture/osteotomy site on sternum

Expose ribs laterally if necessary.

Precaution

- Avoid significant muscle division to preserve as much respiratory function as possible.



2. Determine sternal thickness

Instrument

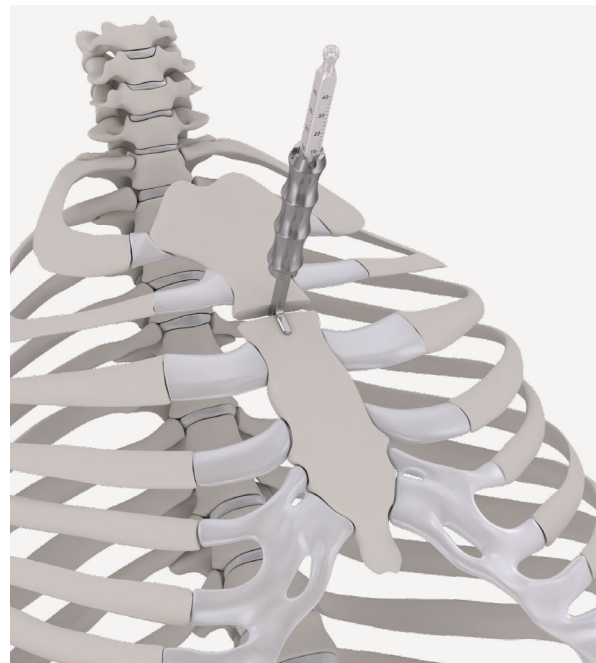
03.501.074 Universal Caliper

Optional Instruments

03.501.065 Caliper

Using caliper, determine bone thickness.

Add 2 mm to the thickness of the sternal edge to account for the plate thickness and to determine the appropriate length drill bit with stop.



Sternal plating technique

3. Approximate sternum to desired position

Instrument

398.400 Reduction forceps with points, narrow, ratchet

Optional instrument

398.903 Sternal Reduction Forceps, angled, with teeth

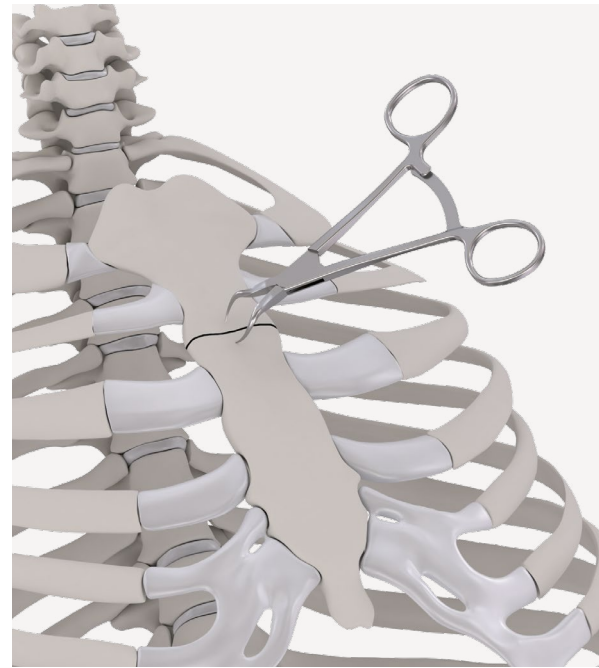
Reduce sternum.

Note

- Sternum can also be reduced with stainless steel surgical wire, if desired.

Precautions

- When placing forceps, care should be taken to avoid the intercostal and mammary vessels and nerves.
- Avoid direct contact of stainless steel wires with titanium implants to prevent galvanic corrosion.



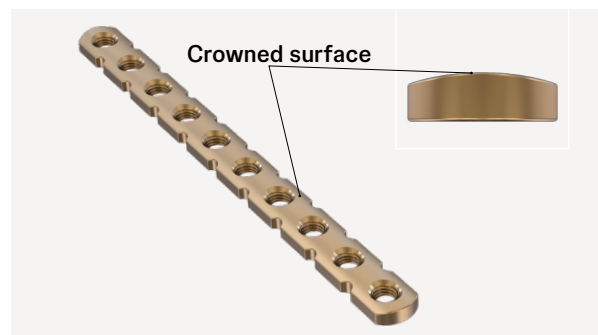
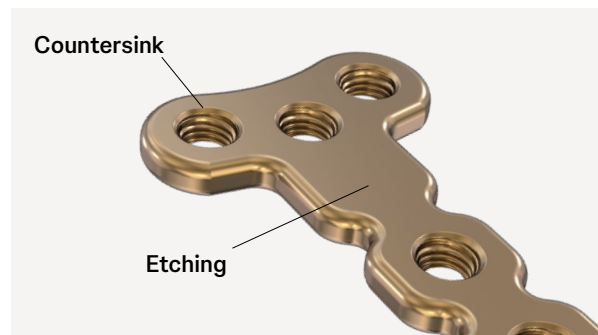
Sternal plating technique

4. Select plate

Select the appropriate plate allowing for a minimum of three screws on each side of the fracture/osteotomy to properly secure the plate. Orient the plate such that the etched surface faces the surgeon. The plate is etched with the part number, and the holes are countersunk on the etched surface to allow the screws to seat fully. Additionally, the straight plates have a crowned, curved top surface, which should be oriented to face the surgeon.

⚠ Precautions

- **Incorrect orientation of the plate, where the etched surface contacts the sternal bone, may result in the inability to lock the screws to the plate, resulting in inadequate fixation.**
- **The MatrixRIB Sternal Plates, 2.8 mm thick, are not intended to be cut.**
- **Use a minimum of three screws on each side of the fracture, to properly secure the plate.**



Sternal plating technique

5. Contour plate (optional)

Instrument

03.501.091 Combination Bending Pliers for MatrixRIB

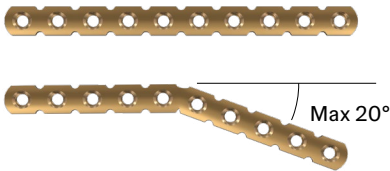
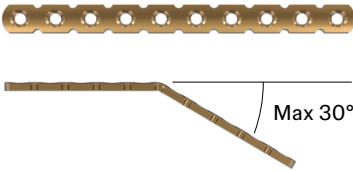
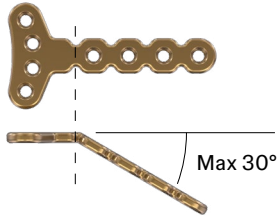
Contour plate to match anatomy, if necessary.

Note

- Bending template can be used to assist in contouring of plate.

Precautions

- 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.
- Use of the incorrect instrumentation for bending may weaken the plate and lead to premature plate failure (e.g. breakage).

Implant	Sharp bend limit for in-plane contouring	Sharp bend limit for out-of-plane contouring
MatrixRIB Straight Plates, 2.8 mm thick 04.501.068 8 holes 04.501.069 9 holes 04.501.095 10 holes		
MatrixRIB Plates, 2.8 mm thick 04.501.093 T Plate, 7 holes 04.501.094 I Plate, 9 holes 04.501.103 T Plate, wide, 8 holes 04.501.104 I Plate, wide, 11 holes	The Sternal T Plates and Sternal I Plates, 2.8 mm thick, are not intended to be contoured in-plane	

Sternal plating technique

(i) In-Plane contouring

MatrixRIB System sternal straight plates, 2.8 mm thick (8, 9, and 10 holes) can be bent In-Plane using the In-Plane bend feature. Place the plate into the jaws marked “First Step” (as shown on the laser etch). Squeeze the handles together to achieve the desired in-plane bend. If additional contouring is desired, then continue sliding the plate through the bender, making small incremental bends.

⚠ Precautions

- Do not contour the sternal straight plates, 2.8 mm thick, beyond the 20° limit In-Plane at a single location.
- The sternal T plates and sternal I plates, 2.8 mm thick, are not intended to be contoured In-Plane.

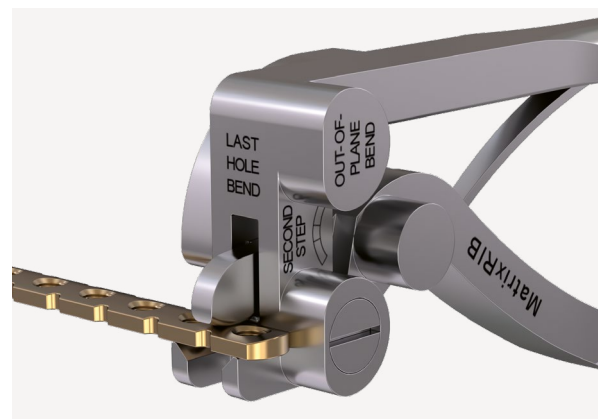


(ii) Out-of-Plane contouring

MatrixRIB System sternal plates, 2.8 mm thick, can be bent Out-of-Plane along the straight section of the plate using either the Out-of-Plane bend feature or the Last Hole Bend feature. The crossbar of the T and I plates are not intended to be contoured. Place the plate into the feature marked “Second Step” or “Last Hole Bend” (as shown on the laser etch). Squeeze handles together to achieve the desired out-of-plane bend. If additional contouring is desired, then continue sliding the plate through the bender, making small incremental bends.

⚠ Precaution

- Do not contour the sternal plates beyond the 30° limit Out-of-Plane at a single location.



Sternal plating technique

6. Position plate

Optional Instruments

03.501.030	MatrixRIB Plate Holding Forceps, small with ball tip
03.501.031	MatrixRIB Plate Holding Forceps, large with ball tip
03.501.708	MatrixRIB Plate Holding Forceps, upright
03.501.709	MatrixRIB Plate Holding Forceps, large
03.501.704	2.2 mm Threaded Reduction Tool for MatrixRIB, AO Quick Coupling

Position plate, allowing for a minimum of three screws on each side of fracture/osteotomy.

If necessary, use plate-holding forceps to keep plate in place. Alternatively, the Threaded Reduction Tool can be used to maintain position of the plate following the section “Threaded reduction tool instructions”.



Sternal plating technique

7. Drill

Instruments

03.501.033	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates
03.501.036– 03.501.050	MatrixRIB Drill Bit Ø 2.2 mm with Stop, length 135/6 mm to length 135/20 mm, for J-Latch Coupling

Thread the drill guide into the plate.

Use drill bit with stop of proper length as determined in Step 2. Recognize that the thickness of the adjacent ribs may be less than the sternal edge.

Drill bits with stop are available with stop lengths ranging from 6 to 20 mm, in 2 mm increments, matching the locking screws.

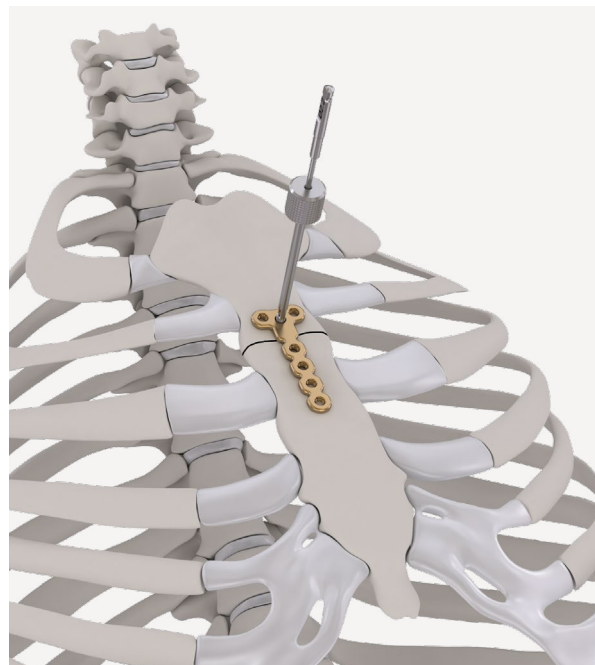
⚠ Precautions

- Irrigate during drilling to avoid thermal damage to the bone.
- Do not drill any deeper than necessary, to avoid the risk of pneumothorax.
- Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.

Remove the 2.2 mm drill guide after drilling.

Option:

- Trocar Instrumentation for MatrixRIB Fixation System may be used for drilling.



Sternal plating technique

8. Confirm sternal thickness (optional)

Instrument

03.501.001 Depth Gauge for Sternal Cable

Optional instrument

03.503.085 Depth Gauge for 2.0 mm to 3.0 mm screws with polymer handle

03.501.702 Cannula for MatrixRIB

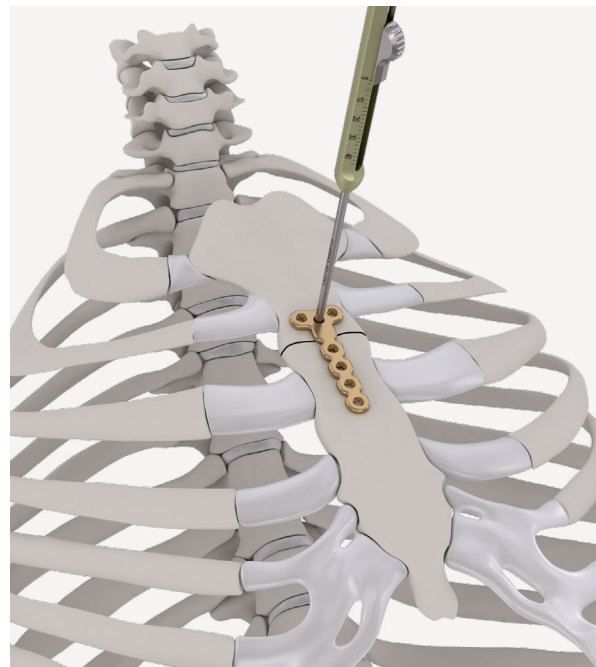
Use depth gauge through plate to confirm the appropriate screw length determined in Step 2.

Precaution

- Do not extend the tip of the depth gauge too far beyond the posterior cortex of the sternum.

Note

- When using the cannula, the 03.503.085 depth gauge must be used.



Sternal plating technique

9. Select and insert screw

Instrument

03.503.071	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, medium
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311.023	Ratcheting Screwdriver Handle
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Optional instrument

03.503.072	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, long
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Select and insert the locking screw (with proper length determined in Step 2) through the plate and tighten until secure. The screw should sit below the top surface of the plate when fully inserted.

Note

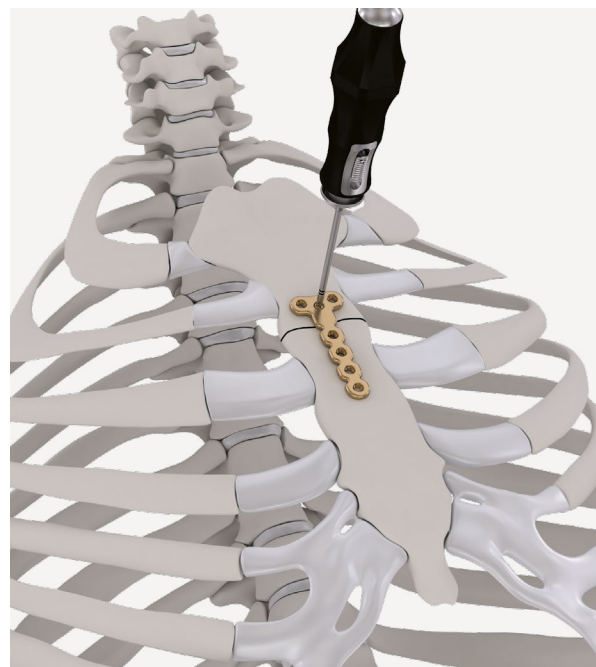
- The screw length indicator on the module can be used to select the appropriate screws.

Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- The non-locking screws are for temporary fixation and will need to be replaced with locking screws before closure.
- Self-drilling screws for plating the rib should not be used with sternal plates. There are no self-drilling screws available for the 2.8 mm MatrixRIB sternal plates.
- In order to determine the appropriate amount of fixation for stability, the surgeon should consider the size and shape of the fracture or osteotomy. The manufacturer recommends at least three screws per plate per fracture side when repairing osteotomies and fractures with this system. Additional fixation is recommended to ensure stability of large fractures and osteotomies.

Options:

- The Trocar Instrumentation for MatrixRIB Fixation System may be used for screw insertion.
- 10 and 12 mm non-locking screws are available to facilitate the plate to sit flush with the bone.



Sternal plating technique

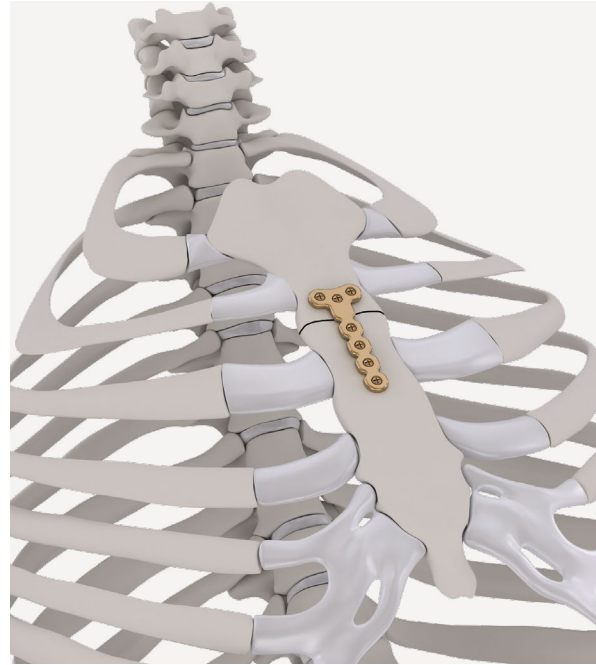
10. Drill and place remaining screws

Verify proper reduction of fracture/osteotomy. Insert a second screw on the opposite side of the sternum following Steps 7 through 9.

Insert all remaining screws in the same manner. If non-locking screws were used, remove and replace with a proper length locking screw.

A Precautions

- If non-locking screws are not replaced with locking screws, the likelihood of implant loosening/migration may be increased.
- Use a minimum of three screws on each side of the fracture, to properly secure the plate.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.



11. Insert remaining plates (optional)

Place remaining plates, if necessary, following Steps 4 through 10.



12. Post-operative considerations

Avoid pulling or lifting the patient by the arms for 6 weeks.

Avoid raising arms higher than 90° at shoulder level.

Avoid contact sports and other activities for which there is the potential for high-velocity impact.

Alternative techniques

Self-drilling screws

Self-drilling locking and non-locking screws are available as an alternative to self-tapping locking and non-locking screws.

Self-drilling screws have a pointed, cutting tip that enables the surgeon to fixate the plate or intramedullary splint in position without drilling a pilot hole.

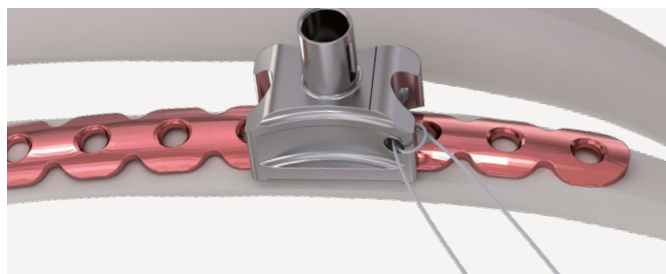
Self-drilling screw guide instruments are provided to ensure coaxial alignment of self-drilling screw in the screw hole. Self-drilling screw guide instruments are used with the 1.5 mm MatrixRIB Plates and MatrixRIB Intramedullary Splints.

⚠ Warnings

- Do not use self-drilling screws in 2.8 mm MatrixRIB Plates or in a 90° approach, which may result in misalignment of the screw during insertion resulting in higher insertion torque, debris formation, and/or inadequate screw locking.
- Improper screw length selection may lead to increased risk of screw protrusion or suboptimal cortex engagement. It's recommended to measure the thickness of each rib as it may vary between ribs.

Self-drilling screw guide for 1.5 mm MatrixRIB Plates (03.501.718) has cut-outs to enable visualization of adjacent screw holes.

Additionally, this guide has a through hole to enable placement of a suture, which can be used as a tether for the screw guide in the event the guide is dropped in situ.



Self-drilling Screw Guide for 1.5 mm MatrixRIB Plates with suture placed as a tether.



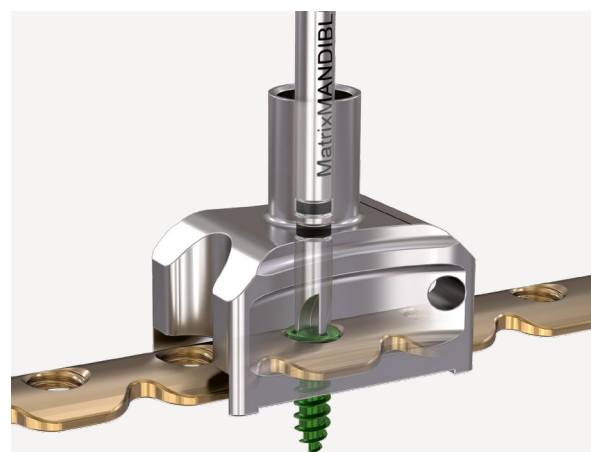
Self-drilling Non-Locking Screw



Self-drilling Locking Screw



03.501.718 Self-drilling Screw Guide for 1.5 mm MatrixRIB Plates



Self-drilling Screw insertion with Guide for 1.5 mm MatrixRIB Plates

Alternative techniques

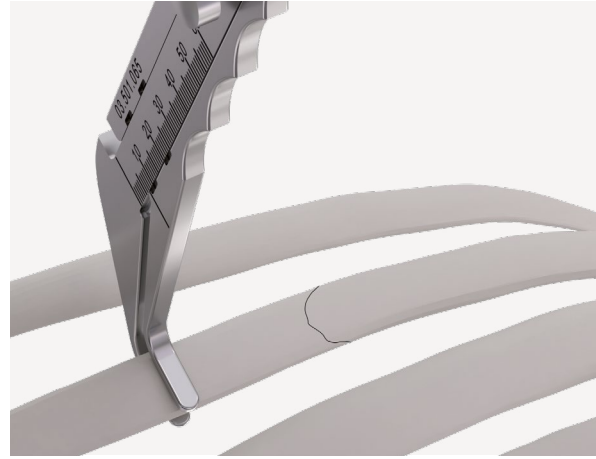
Self-drilling screws technique for 1.5 mm MatrixRIB Plates

1. Measure bone thickness and position plate

Measure the rib bone thickness (using 03.501.065) and position the plate as described in Steps 1–7 of the plating the rib section. Record measurement for use in screw selection in Step 3 below.

Precaution

- 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.



Alternative techniques

2. Position screw guide on plate

Instrument

03.501.718 Self-Drilling Screw Guide for 1.5 mm
MatrixRIB

With the plate positioned on the bone, align the screw guide with the plate. The screw guide should sit flush on the plate.

Additional contouring of the plate may affect the ability of the screw guide to engage the plate and align the screw, resulting in difficulty locking the screw.

The screw guide engages the plate along one pair of opposing side cuts. The etched line on the screw guide indicates the location of the side cuts. If the screw guide is difficult to engage the plate, rotating the screw guide to engage the opposite side cuts, may improve engagement.

Additionally, the presence of soft tissue in the side cuts of the plate may inhibit the engagement of the screw guide around the plate. Clearing the soft tissue may help improve engagement of screw guide to plate.

⚠ Precaution

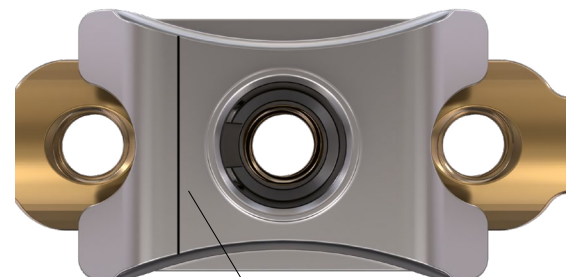
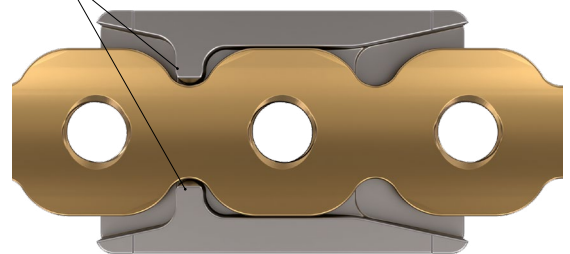
- Improper alignment of the screw guide with the plate may result in off-axis insertion of the screw, resulting in inadequate locking of the screw and/or screw head sitting proud above the plate.

■ Notes

- If there is difficulty or inability to engage the screw guide, self-tapping locking screws should be used.
- For additional stabilization of the screw guide on the plate, plate holding forceps can be used (03.501.071, 03.501.709).
- Ensure screw guide does not shift position during clamping.



Side Cuts Interface



Etched Line indicates location of side cut interface

Alternative techniques

2a. Insert cannula (optional)

Instruments

03.501.718	Self-Drilling Screw Guide for 1.5 mm MatrixRIB
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03.501.702	Cannula for MatrixRIB
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03.501.703	Trocar for MatrixRIB
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03.506.003	Tissue Retractor Forceps
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397.211	Universal Trocar Handle
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Optional instruments

03.501.071	MatrixRIB Plate Holding Forceps, small
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03.501.709	MatrixRIB Plate Holding Forceps, large
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If soft tissue flap or additional instrumentation interferes with proper placement of the screw guide, the cannula can be attached to the screw guide and used as a handle. The cannula can be used with or without the trocar handle.

Additionally, the cannula can be placed percutaneously and attached to the screw guide in situ.

Note

- **When using the Cannula, the long screwdriver blade (03.503.072) must be used for screw insertion.**

i. Percutaneous placement

After creating a stab incision, pass the cannula with trocar carefully through the soft tissue over the plate hole, then remove the trocar.

Clamp the tissue retractor forceps around the cannula through the primary access incision to retract the soft tissue.

Insert the screw guide through the primary access incision and attach securely to the cannula. With the plate held in place on the bone, position the screw guide onto the plate by aligning it onto the plate hole.



Alternative techniques

3. Select and insert screw

Instruments

03.501.065	Caliper
03.501.718	Self-drilling Screw Guide for 1.5 mm MatrixRIB Plates
03.503.072	MatrixMANDIBLE™/THORAX Self-retaining Screwdriver Blade, long
311.023	Ratcheting Screwdriver Handle

Optional instrument

03.503.071	MatrixMANDIBLE™/THORAX Self-retaining Screwdriver Blade, medium
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To select the appropriate screw length, add 2 mm to the measurement recorded in Step 2 of the Plating rib section to allow for plate thickness - round down according to the chart.

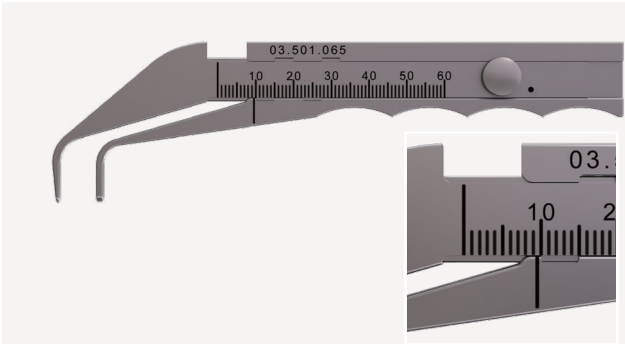
Self-drilling screws are provided in 1 mm increments to enable bicortical placement, such that the tip of the screw engages the inner cortex of the rib.

The screw length indicator on the module can be used as a reference to confirm screw length.

Certain clinical factors may result in the need to reaffirm required screw length with the plate positioned on the bone (such as the presence of soft tissue and the amount of space, if any, between the plate and the bone).

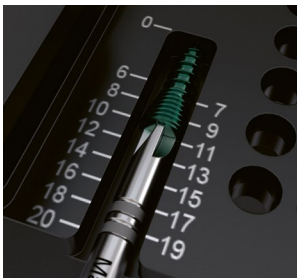
⚠ Warnings

- If the tip of the screw does not engage the inner cortex of the rib, the risk of screw pullout may be increased.
- If the tip of the screw extends too far beyond the inner cortex, the risk of injury to underlying tissues may be increased.



Example, bone thickness measurement = 9.5 mm. Choose 11 mm screw length (03.501.065).

Measured Bone Thickness	Recommended Screw Length
6.0 –7.0 mm	8 mm
7.0 –8.0 mm	9 mm
8.0 –9.0 mm	10 mm
9.0 –10.0 mm	11 mm
10.0 –11.0 mm	12 mm
11.0 –12.0 mm	13 mm
12.0 –13.0 mm	14 mm
13.0 –14.0 mm	15 mm
14.0 –15.0 mm	16 mm
15.0 –16.0 mm	17 mm
16.0 –17.0 mm	18 mm
17.0 –18.0 mm	19 mm
18.0 –19.0 mm	20 mm



Screw length indicator on module.

Alternative techniques

While holding the Screw Guide in position, insert the proper length self-drilling locking screw through screw guide and tighten until secure in the plate. Final tightening may be necessary after screw guide is removed. The screw head should seat flush with the surface of the plate.

Option

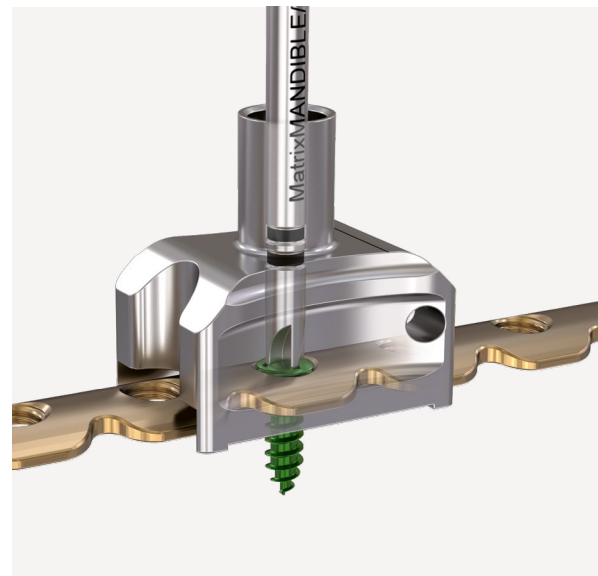
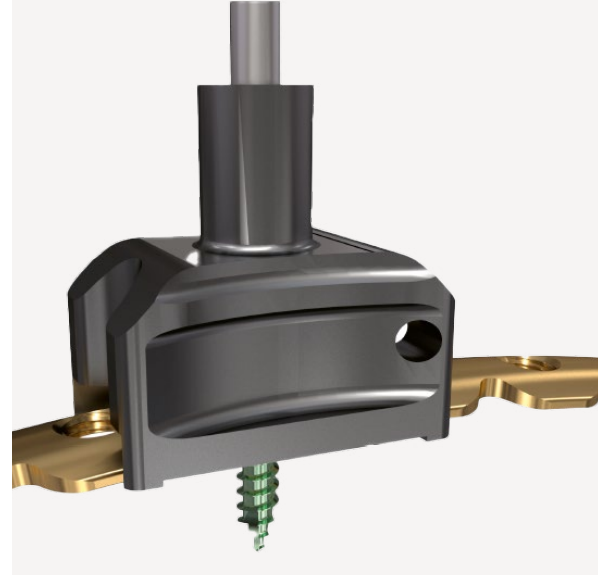
10 and 12 mm non-locking self-drilling screws are available to facilitate the plate to sit flush with the bone.

■ Notes

- If the measurement is taken with the plate positioned on the bone, choose the screw length that matches the measured thickness without adding 2 mm.
- If the measured bone thickness requires a screw length smaller than 8 mm, a 6 mm Self-Tapping Screw (and MatrixRIB Self-tapping Screw Instrumentation) should be used.
- If there is difficulty or inability to insert screws due to dense bone or inability to use the screw guide, self-tapping screws should be used.
- Once the screw is started in the bone, the screw guide can be lifted along the driver blade to ensure that the plate is flush with the bone.

⚠ Precautions

- The non-locking screws are for temporary fixation and will need to be replaced with locking screws before closure.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container, in accordance with hospital procedures.
- Irrigate and apply suction for removal of debris potentially generated during implantation.
- Improper engagement of the screwdriver blade with the screw and/or overtightening during insertion may deform, strip or break the screw, which may make further tightening or eventual removal more difficult, and the screwdriver blade may deform or slip out of the screwhead drive recess.



Alternative techniques

Self-drilling screws for intramedullary splints

1. Position screw guide on splint

Instruments

03.501.719 Self-Drilling Screw Guide for MatrixRIB
Intramedullary Splints

Optional instrument

03.501.702 Cannula for MatrixRIB

With the splint placed in the bone as described in Steps 1–5 of the Splint insertion technique, align the screw guide with the splint. The screw guide should sit flush on the splint.

The presence of soft tissue on the bone may affect the engagement of the screw guide to the splint. Clearing the soft tissue may help improve engagement of screw guide to plate.

■ Notes

- If there is difficulty or inability to engage the screw guide, a self-tapping locking screw can be used.
- Once the screw is started in the bone, the screw guide can be lifted along the driver blade to ensure that the splint is flush with the bone.

⚠ Precaution

- Improper alignment of the screw guide with the splint may result in off-axis insertion of the screw, resulting in inadequate locking of the screw and/or screw head protrusion above the splint.

Alternatively, if soft tissue or additional instrumentation interferes with proper placement of the screw guide, the cannula can be attached to the screw guide and used as a handle. The cannula can be used with or without the trocar handle.



03.501.719 Self-drilling Screw Guide
MatrixRIB Intramedullary Splints

Alternative techniques

2. Select and insert screw

Instruments

03.501.065	Caliper
03.501.719	Self-Drilling Screw Guide for MatrixRIB Intramedullary Splints
03.503.072	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, long
311.023	Ratcheting Screwdriver Handle

Optional instrument

03.501.702	Cannula for MatrixRIB
03.503.071	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, medium

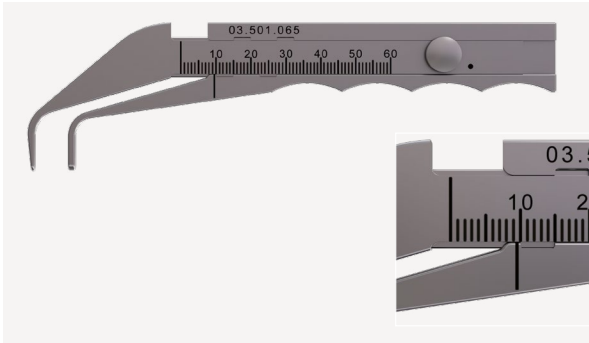
To select the appropriate screw length, add 1 mm to the measurement recorded in Step 2 of the Splint insertion technique to allow for splint thickness – round down according to the chart.

Self-Drilling Screws are provided in 1 mm increments to enable bicortical placement, such that the tip of the screw engages the inner cortex of the rib.

The screw length indicator on the module can be used to confirm screw length.

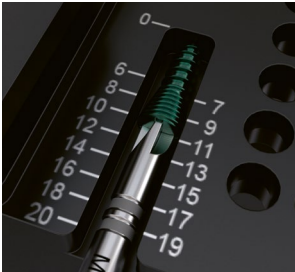
⚠ Warnings

- If the tip of the screw does not engage the inner cortex of the rib, the risk of screw pullout may be increased.
- If the tip of the screw extends too far beyond the inner cortex, the risk of injury to underlying tissues may be increased.



Example, bone thickness measurement = 9.5 mm.
Choose 10 mm screw length (03.501.065).

Measured bone thickness	Recommended screw length
7.0 –8.0 mm	8 mm
8.0 –9.0 mm	9 mm
9.0 –10.0 mm	10 mm
10.0 –11.0 mm	11 mm
11.0 –12.0 mm	12 mm
12.0 –13.0 mm	13 mm
13.0 –14.0 mm	14 mm
14.0 –15.0 mm	15 mm
15.0 –16.0 mm	16 mm
16.0 –17.0 mm	17 mm
17.0 –18.0 mm	18 mm
18.0 –19.0 mm	19 mm



Screw length indicator on module.

Alternative techniques

While holding the Screw Guide in position, insert the proper length self-drilling locking screw through screw guide and tighten until secure in the splint. Final tightening may be necessary after screw guide is removed.

Precautions

- **Improper engagement of the screwdriver blade with the screw and/or overtightening during insertion may deform, strip or break the screw, which may make further tightening or eventual removal more difficult, and the screwdriver blade may deform or slip out of the screwhead drive recess.**
- **After implant placement is complete, discard any fragments or modified parts in an approved sharps container, in accordance with hospital procedures.**
- **Irrigate and apply suction for removal of debris potentially generated during implantation.**

Notes

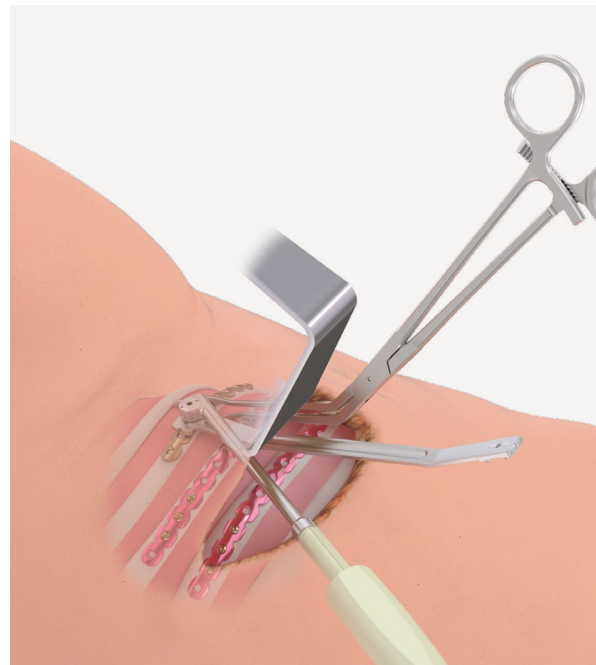
- **If the measurement is taken with the splint positioned on the bone, choose the screw length that matches the measured thickness without adding 1 mm.**
- **If the measured bone thickness requires a screw length smaller than 8 mm, a 6 mm Self-Tapping Screw is available.**
- **If there is difficulty or inability to insert screws due to dense bone or the inability to use the screw guide, self-tapping screws can be used.**

MIPO technique

Minimally Invasive Plate Osteosynthesis (MIPO)

MIPO instruments offer additional approach options than the original MatrixRIB Fixation System.

The MIPO instrumentation includes the following: Trocar Instruments, Threaded Reduction Tool, and instruments for the 90° Screwdriver.



MIPO technique

Caliper forceps instructions for MatrixRIB Fixation System

Measure rib thickness using caliper forceps

Instruments

03.501.715 Caliper Forceps

The caliper forceps can be used to measure the rib when surgical access to the bone is limited, such as in the percutaneous approach.

The tip of the caliper forceps can be inserted through an existing access in the intercostal space. The tip of the caliper forceps can also be used for blunt dissection of the intercostal muscle.

Align the tips of the caliper forceps along the midpoint of the bone to ensure proper measurement.

⚠ Precaution

- Be careful not to pinch hand or gloves, or injure yourself when using the caliper forceps.

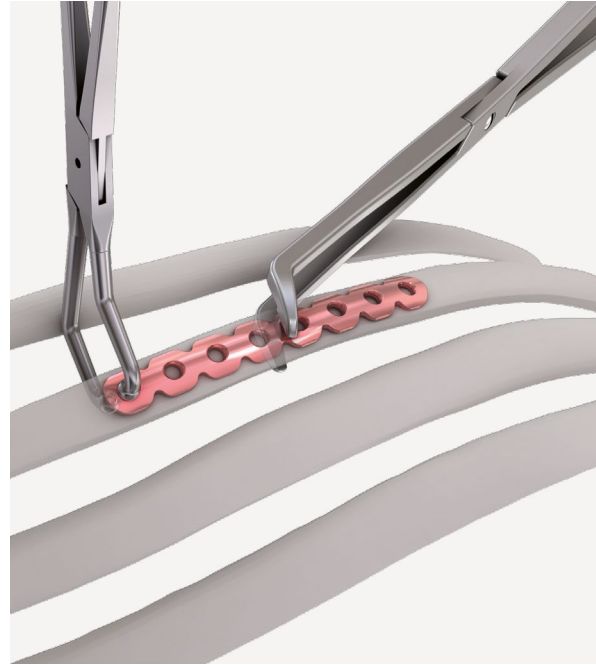
⚠ Precaution

- If the caliper forceps are clamped too tightly during measurement, the caliper forceps may flex, resulting in a rib thickness measurement that is smaller than the actual thickness of the rib.

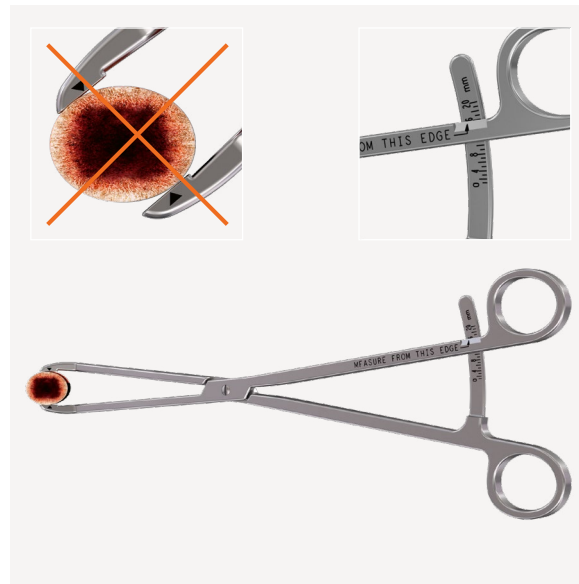
To select the appropriate drill bit with stop and/or the appropriate screw length, add 2 mm to the measurement to allow for the plate thickness. If the bone is measured with the plate in place, do not add 2 mm.

⚠ Precaution

- Take care to avoid damaging the nerve and vessel bundle at the inferior border of the rib.



Measuring rib thickness with the plate positioned on the bone.



MIPO technique

Trocar instruments instructions for MatrixRIB Fixation System

1. Insert cannula

Instruments

397.211	Universal Trocar Handle
03.501.700	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long
03.501.702	Cannula for MatrixRIB System
03.501.703	Trocar for MatrixRIB System

After creating a stab incision, pass the cannula with trocar carefully through the soft tissue over the plate hole, then remove the trocar.

Note

- The cannula can be used with or without the universal trocar handle.



MIPO technique

2. Drill

Instrument

03.501.700 2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long

Optional instrument

03.506.003 Tissue Retractor Forceps

Thread drill guide into the plate through the cannula.

Select the appropriate drill bit with stop* and drill.

⚠ Precautions

- Irrigate during drilling to avoid thermal damage to the bone.
- Do not drill any deeper than necessary, to avoid risk of pneumothorax.
- Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.

Remove drill guide.

■ Note

- Retraction forceps may be used to retract soft tissue.



* Length determined in Step 2 of the plating rib or plating sternum instructions.

MIPO technique

3. Select and insert screw

Select the appropriate length screw* and insert into the cannula and through the plate, and tighten until secure.

⚠ Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- In order to determine the appropriate amount of fixation for stability, the surgeon should consider the size and shape of the fracture or osteotomy. The manufacturer recommends at least three screws per plate per fracture side when repairing osteotomies and fractures with this system. Additional fixation is recommended to ensure stability of large fractures and osteotomies.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.

■ Note

- Screws can be measured using the screw length indicator on the module.



* Length determined in Step 2 of the plating rib or plating sternum instructions.

MIPO technique

Threaded reduction tool instructions

1. Thread drill guide to plate

Instrument

03.501.700	2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long
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03.501.702	Cannula for MatrixRIB System
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03.501.703	Trocar for MatrixRIB System
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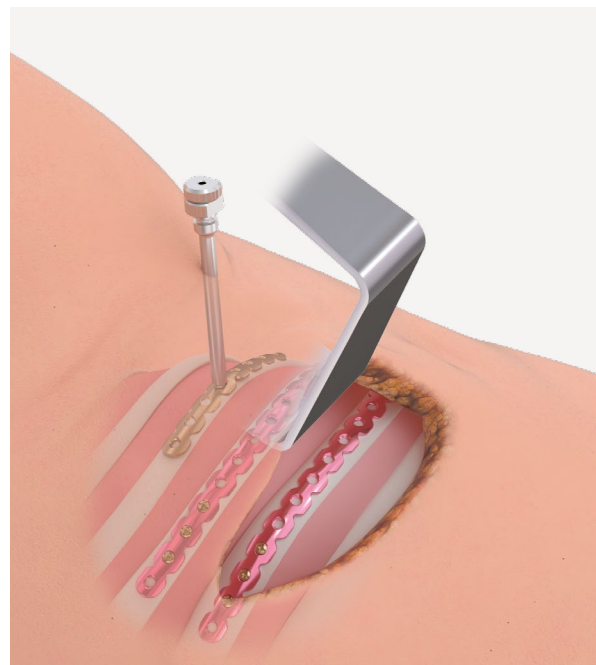
Optional instrument

03.501.033	2.2 mm Threaded Drill guide for MatrixRIB Locking Plates (for open approach)
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Create a stab incision and pass cannula with trocar carefully through the soft tissue over the plate hole, then remove the trocar.

Thread the drill guide into the plate hole.

The Threaded Reduction Tool can also be used where direct access to the plate exists without the need to use the cannula and trocar. In an open approach, the drill guide is still needed.



MIPO technique

2. Insert threaded reduction tool through drill guide

Instrument

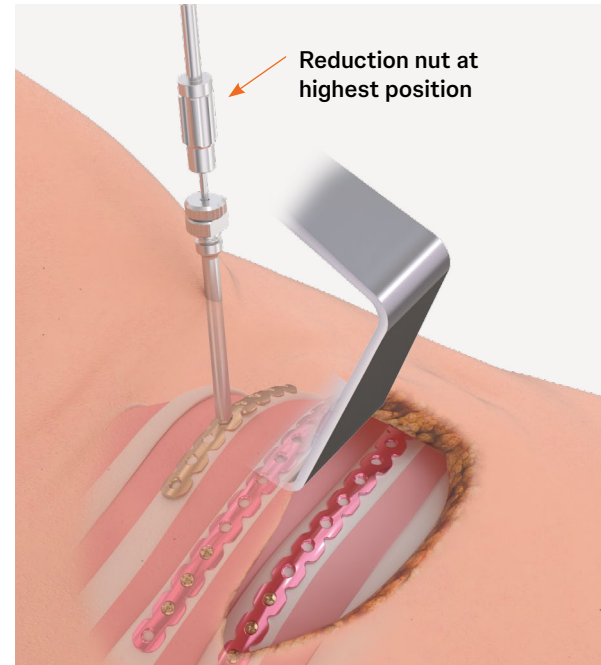
03.501.704 2.2 mm Threaded Reduction Tool for MatrixRIB System, AO Quick Coupling

With the Threaded Reduction Tool attached to a power source, place it in drill guide.

With the reduction nut in the highest position possible, begin power insertion of the Threaded Reduction Tool slowly.

Precaution

- The Threaded Reduction Tool has a maximum insertion length of 15 mm. To avoid injuries, limit the insertion depth according to the patient's rib thickness. Stop insertion before the Threaded Reduction Tool contacts the top surface of the drill guide. Continuing to power after contacting the top surface of the drill guide may cause the Threaded Reduction Tool threads to strip in the bone.



MIPO technique

3. Remove the power source

Remove the power source and begin tightening the reduction nut toward the drill guide while monitoring progress of bone/plate contact.



4. Reduce bone to plate

Stop when the desired reduction is achieved.

Note

- The Threaded Reduction Tool allows later placement of a 2.9 mm MatrixRIB Locking Screw in the same hole—after removal of the Threaded Reduction Tool.

Precautions

- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.



MIPO technique

90° Screwdriver instructions for MatrixRIB Fixation System

1. Drilling with 90° screwdriver

Instruments

2.2 mm MatrixRIB Drill Guide for 90° Screwdriver

03.501.751 with 0–90°

03.501.752 with 45–45°

03.501.756- 2.2 mm Drill Bits with stop for 90°

03.501.770 Screwdriver, 6 mm to 20 mm

Engage and hold the desired angled drill guide on the desired plate hole.

Note

- Ensure the head of drill guide is seated flat on top of the plate to ensure proper engagement.

Select the appropriate drill bit with stop* and drill. Drill bits can be measured using the drill bit length indicator on the module.

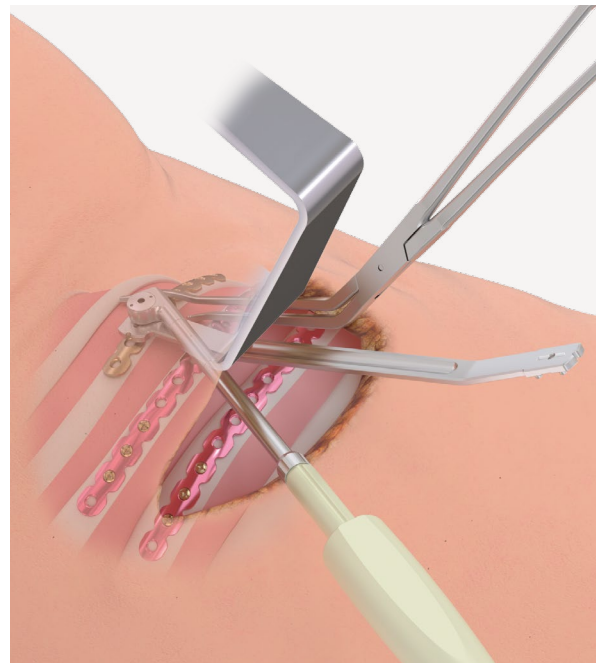
Precautions

- Do not drill any deeper than necessary to avoid the risk of pneumothorax.
- Irrigate during drilling to avoid thermal damage to the bone.
- Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.

Remove drill guide after drilling.

Note

- 90° Screwdriver may stall during drilling if drill bit is misaligned with the drill guide.



* Length determined in Step 2 of the plating rib instructions.

MIPO technique

2. Insert screw

Instrument

03.501.750 MatrixRIB Screwdriver Blade for 90° Screwdriver, self-retaining

Select the appropriate length screw* and insert it through the plate and tighten until secure.

Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.

Note

- Screws can be measured using the screw length indicator on the module.



*Length determined in Step 2 of the plating rib instructions.

Chest wall reconstruction

Chest wall reconstruction, including spanning gaps

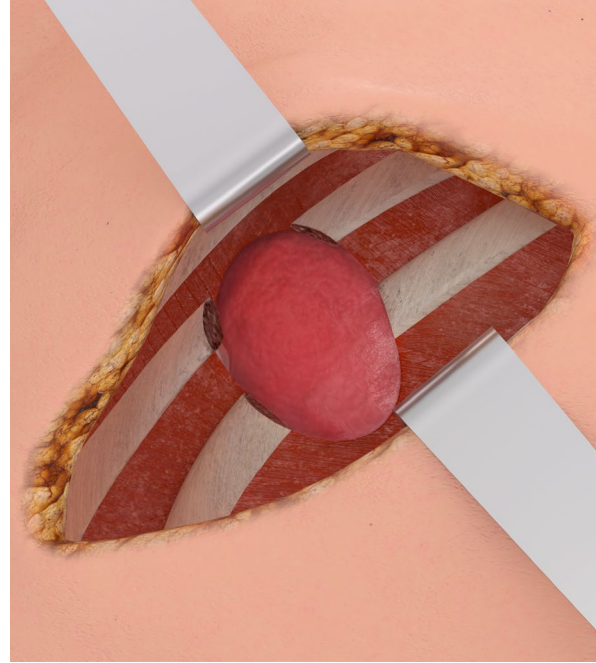
1. Expose surgical site

Incise and elevate soft tissues as required to gain access to the surgical site.

Excise non-viable soft tissues and boney structures. Ensure enough viable bone is available for a minimum of three screws on either side of the osteotomy.

⚠ Warning:

- When implants are used to bridge gaps after chest wall resections there is potential risk for herniation and adhesion of the underlying organs/soft tissue.



Chest wall reconstruction

2. Determine rib/sternal thickness

Instrument

03.501.074 Universal Caliper

Optional instrument

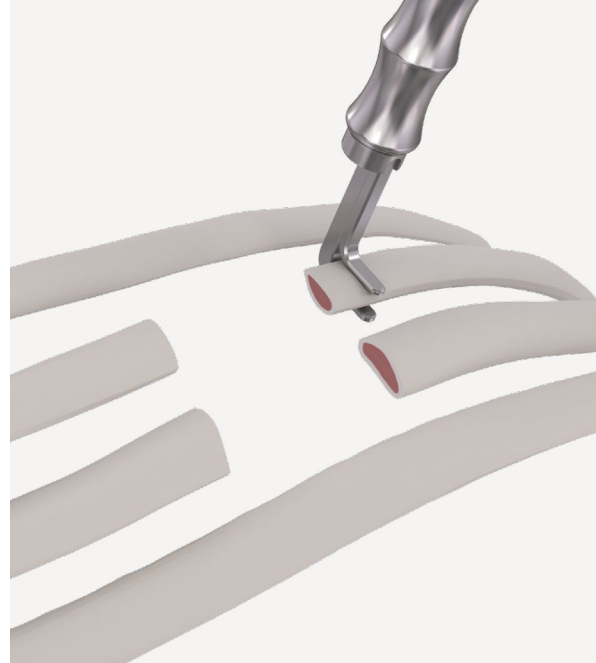
03.501.065 Caliper

Determine rib/sternal thickness with the caliper.

To select the appropriate drill bit with stop and the appropriate screw length, add 2 mm to allow for the plate thickness.

Precaution

- Take care to avoid damaging the nerve and vessel bundle at the inferior border of the rib.



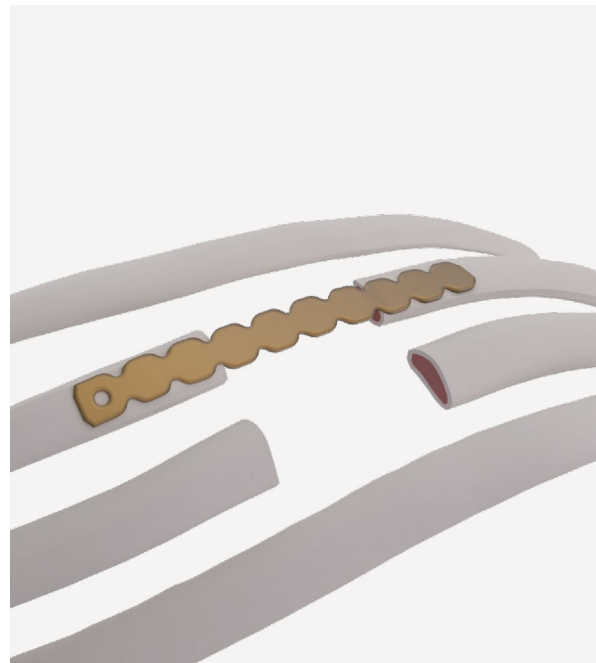
3. Cut and contour bending template (optional)

Instrument

03.501.090 Bending Template for MatrixRIB Locking Plates,
300 mm length

Cut the bending template to a length that allows placement of a minimum of three screws on the rib/sternum on either side of the osteotomy.

Contour the template to the desired anatomical result.



Chest wall reconstruction

4. Select and cut plate (optional)

Instrument

03.503.057 Short Cut Plate Cutter (2 required)

Use the plate template contoured in Step 4 to select the best matching plate.

Note

- Position the precontoured plate with the marking toward the sternum.

If necessary, cut the plate to the desired length.

Precaution

- In order to determine the appropriate amount of fixation for stability, the surgeon should consider the size and shape of the fracture or osteotomy. The manufacturer recommends at least three screws per plate per fracture side when repairing osteotomies and fractures with this system. Additional fixation is recommended to ensure stability of large fractures and osteotomies.



5. Contour plate (optional)

Instrument

03.501.091 Combination Bending Pliers for MatrixRIB

Using the bending pliers, contour the plate to match the template.

Precaution

- 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.



Chest wall reconstruction

6. Position plate

Instrument

03.501.071 MatrixRIB Plate Holding Forceps, small

Optional instruments

03.501.030 MatrixRIB Plate Holding Forceps, small, with ball tips

03.501.031 MatrixRIB Plate Holding Forceps, large, with ball tips

03.501.704 Threaded Reduction Tool for MatrixRIB, AO Quick Coupling (see section “Threaded reduction tool instructions”)

03.501.708 MatrixRIB Plate Holding Forceps, upright with ball tip

03.501.709 MatrixRIB Plate Holding Forceps, large

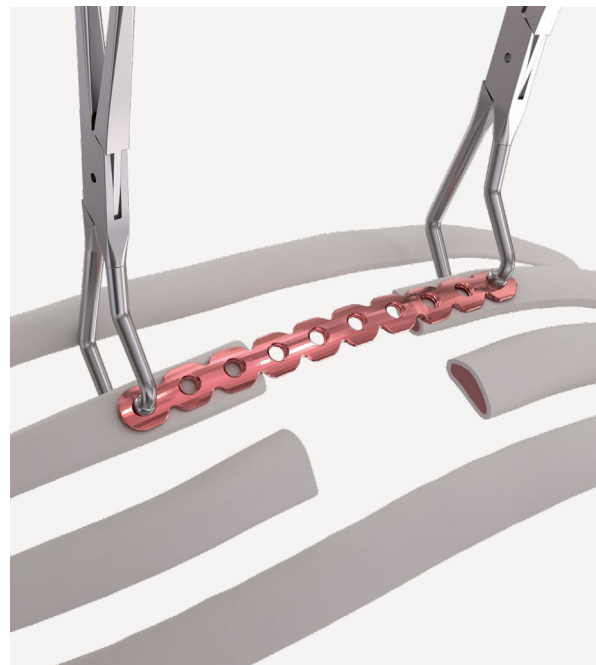
Position the plate over the osteotomy, allowing for the placement of a minimum of three screws on the rib/sternum on either side of the defect.

Verify the contour of the plate matches the desired anatomical result.

Using the plate holding forceps, hold the plate on the bone.

Precaution

- 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.



Chest wall reconstruction

7. Drill

Instrument

03.501.033 2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates

03.501.036– MatrixRIB Drill Bit Ø 2.2 mm with Stop, length 135/6 mm

03.501.050 to length 135/20 mm, for J-Latch Coupling

Optional instruments

03.501.700 2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates, long

Thread the drill guide into the plate.

Select the drill bit with stop as determined in Step 3 and drill.

Drill bits with stop are available with stop lengths ranging from 6 mm to 20 mm, in 2 mm increments, matching the locking screw lengths.

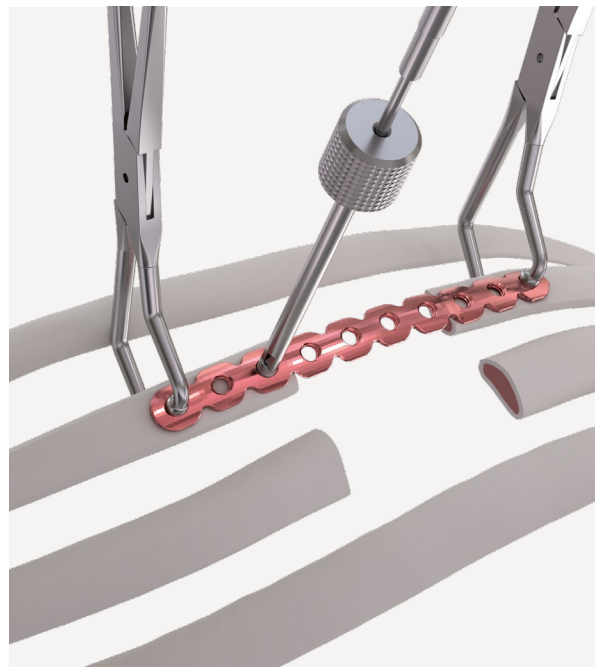
⚠ Precautions

- Irrigate during drilling to avoid thermal damage to the bone.
- Do not drill any deeper than necessary to avoid the risk of pneumothorax.
- Drilling speed should never exceed 1800 rpm. Higher speeds can result in thermal necrosis of the bone and increased hole diameter and may lead to unstable fixation.

Remove the 2.2 mm drill guide after drilling.

Options:

- The Trocar Instrumentation for MatrixRIB Fixation System may be used for drilling (see section “Trocar instruments instructions for MatrixRIB Fixation System”).
- The 90° Screwdriver for MatrixRIB Fixation System may be used for drilling (see section “90° Screwdriver instructions for MatrixRIB Fixation System”).



Chest wall reconstruction

8. Confirm rib/sternal thickness (optional)

Instruments

03.501.001 Depth Gauge for Sternal Cable

Optional instrument

03.503.085 Depth Gauge for MatrixMANDIBLE™,
measuring range up to 40 mm

03.501.702 Cannula for MatrixRIB

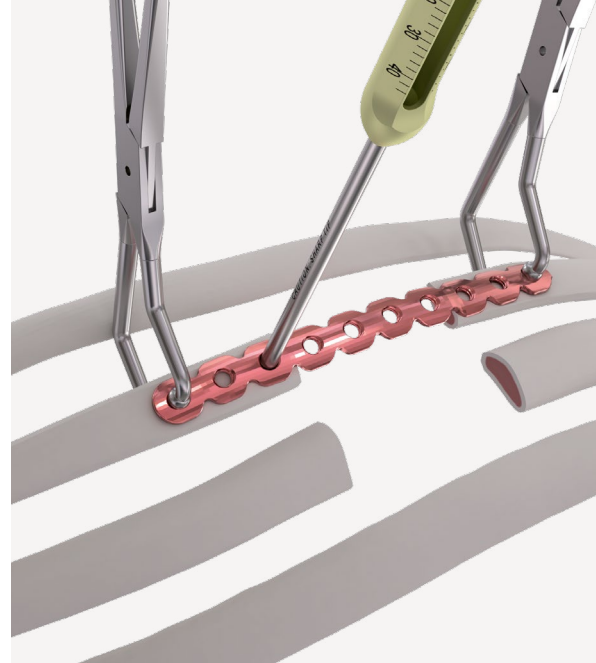
Use the depth gauge through the plate to confirm the appropriate screw length determined in Step 3.

⚠ Precaution

- Do not extend the tip of the depth gauge too far beyond the posterior cortex of the rib.

■ Note

- When using the cannula, the 03.503.085 depth gauge must be used.



Chest wall reconstruction

9. Select and insert screw

Instruments

03.503.071	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, medium
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311.023	Ratcheting Screwdriver Handle
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Optional instrument

03.503.072	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, long
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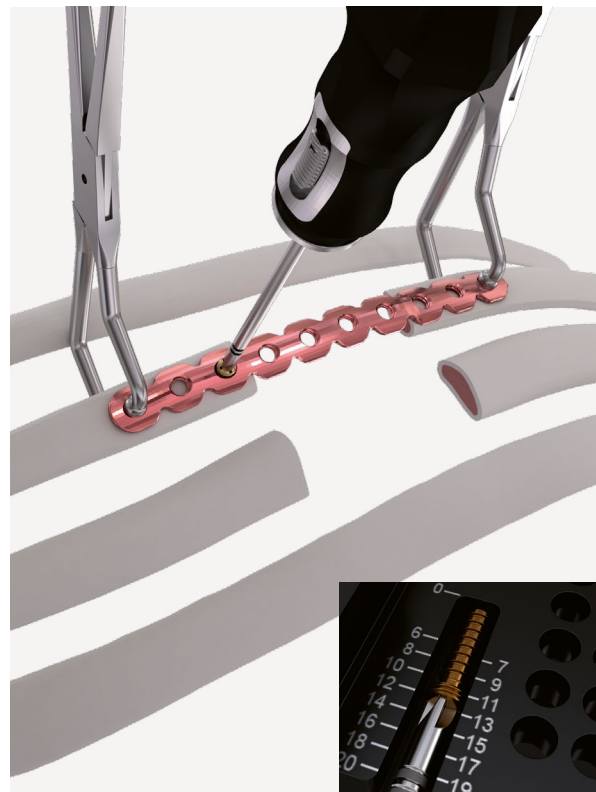
Select and insert the locking screw (with proper length determined in Step 3) through the plate and tighten until secure.

Note

- The screw length indicator on the module can be used to select the appropriate screws.

Precautions

- The screw should be placed bicortically. The tip of the screw should not extend too far beyond the posterior cortex to avoid deeper injury.
- In order to determine the appropriate amount of fixation for stability, the surgeon should consider the size and shape of the fracture or osteotomy. The manufacturer recommends at least three screws per plate per fracture side when repairing osteotomies and fractures with this system. Additional fixation is recommended for stability of large fractures and osteotomies.



Chest wall reconstruction

Options

- The MatrixRIB Trocar Instruments may be used for screw insertion (see section “Trocar instruments instructions for MatrixRIB Fixation System”).
- The 90° Screwdriver for MatrixRIB Fixation System may be used for screw insertion (see section “90° Screwdriver instructions for MatrixRIB Fixation System”).
- 10 and 12 mm non-locking screws are available to facilitate the plate to sit flush with the bone.
- Self-drilling screws may be used as an alternative to self-tapping screws in 1.5 mm plates (see section “Self-drilling screws technique for 1.5 mm MatrixRIB Plates”).

Precaution

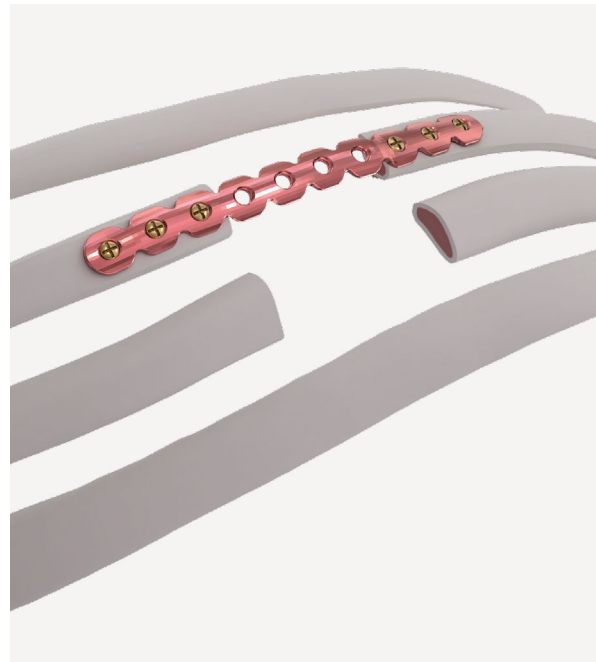
- **The non-locking screws are for temporary fixation and will need to be replaced with locking screws before closure.**

10. Drill and place remaining screws

Insert a second screw on the opposite side of the osteotomy following Steps 8 and 10. Insert remaining screws in the same manner.

Precaution

- **If non-locking screws are not replaced with locking screws, the likelihood of implant loosening/migration may be increased.**



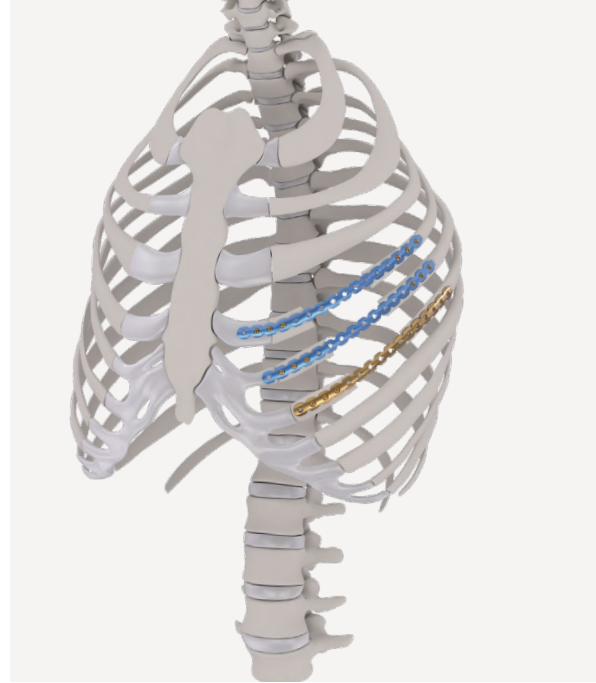
Chest wall reconstruction

11. Insert remaining plates (optional)

Insert remaining plates as per Steps 3 through 11. A minimum of three long MatrixRIB straight plates (24 or 30 holes) is recommended for transverse sternal reconstruction.

Precautions

- A minimum of three plates is recommended for sternal reconstruction.
- After implant placement is complete, discard any fragments or modified parts in an approved sharps container.
- Irrigate and apply suction for removal of debris potentially generated during implantation.



12. Post-operative considerations

Avoid pulling or lifting the patient by the arms for six weeks.
Avoid raising arms higher than 90° at shoulder level.

Chest wall deformity repair

Chest wall deformity repair, including pectus deformities

1. Expose surgical site

Incise and elevate soft tissues as required to gain access to the surgical site.

2. Release deformed sections of chest wall

Perform transverse wedge osteotomy(ies) across the anterior table of the sternum to elevate and twist the sternum to the desired anatomic position.

Make rib osteotomies and resect the deformed costal cartilage subperichondrially as needed to facilitate the realignment of the chest wall.

Precaution

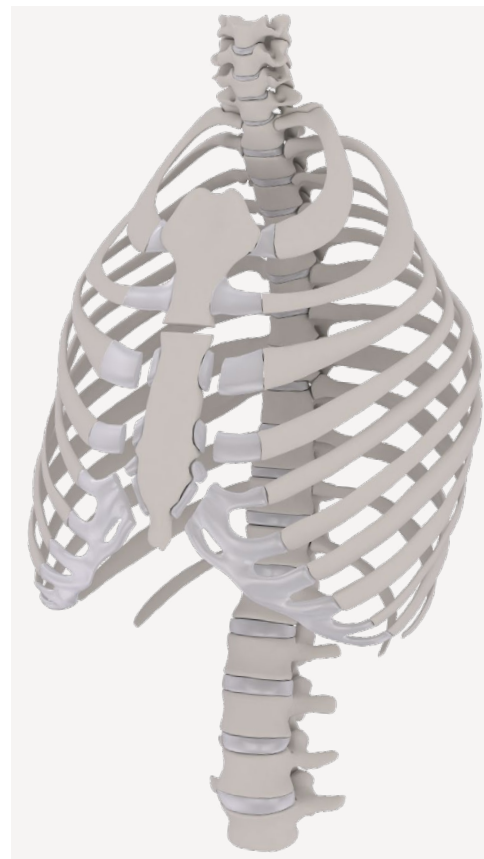
- Avoid significant muscle division to preserve as much respiratory function as possible.

Notes

- The perichondrium should be preserved.
- Several wedge osteotomies on a rib may be required for full anatomical repositioning.
- Division of the xiphoid process, bilateral subperichondrial dissection of the cartilage, osteotomy of the anterior sternal cortex and retrosternal dissection may help facilitate to release the tension required to elevate the sternum into the desired anatomic position.
- Minimally invasive instrumentation is available (section “Minimally Invasive Plate Osteosynthesis (MIPO)”) for drilling and screw insertion.

3. Realign the anterior chest wall into desired anatomic position

Reduction forceps can be used to manipulate segments into desired anatomic position.



Chest wall deformity repair

4. Position and fixate plate(s)

For sternal body plating, follow the section “Sternal plating technique”.

If the sternum needed to be osteomized on different locations, more sternal plates can be used.

For rib or rib/sternal plating, follow the section “Rib plating technique”.

The chest wall reconstruction approach in section “Chest wall reconstruction” can also be referenced.

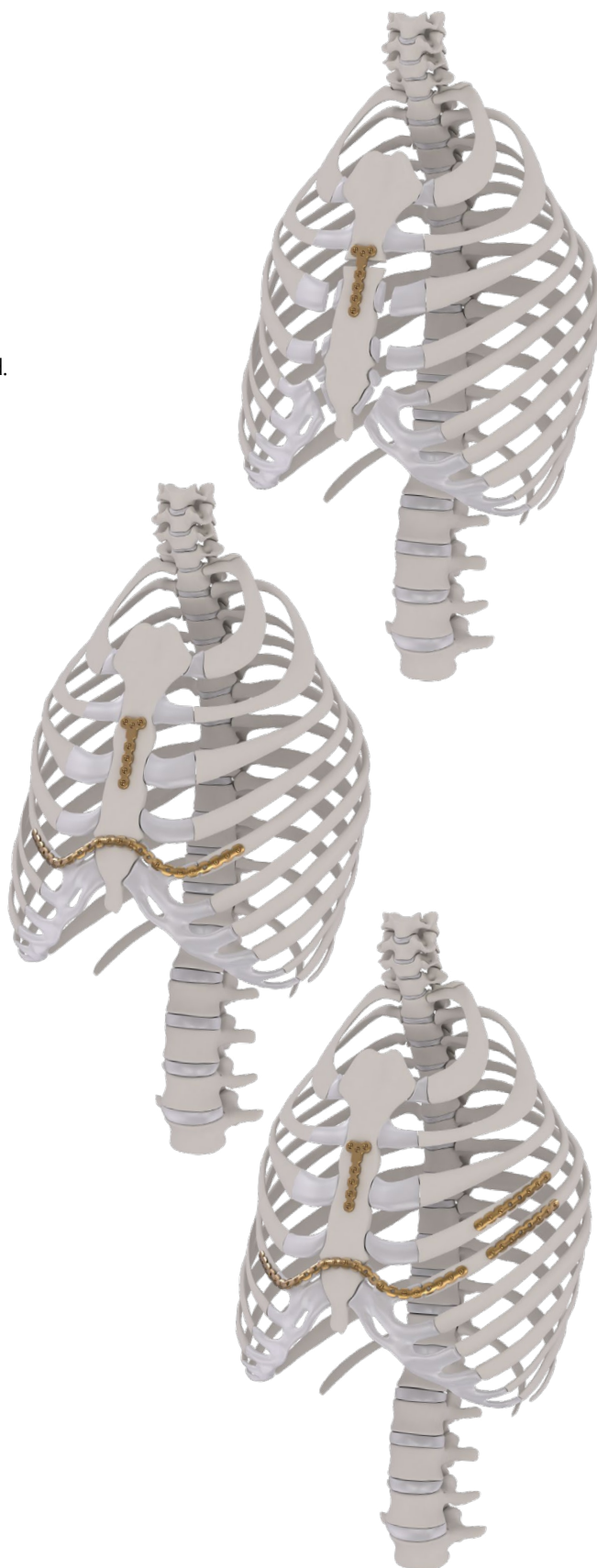
If long MatrixRIB System straight plates (24 or 30 holes) are used for rib-to-sternum-to-rib plating, more intensive plate contouring is required.

⚠ Precautions

- 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.
- Use of the incorrect instrumentation for bending may weaken the plate and lead to premature plate failure (e.g. breakage).
- Do not bend the plate beyond what is required to match the anatomy.
- Use a minimum of three screws on each side of the osteotomy to properly secure the plate.

■ Note

- Number, type, and orientation of plates is based on individual patient anatomy, severity of deformity, and surgeon preference.



Chest wall deformity repair

5. Post-operative considerations

Avoid pulling or lifting the patient by the arms for 6 weeks.

Avoid raising arms higher than 90° at shoulder level.

Avoid contact sports and other activities for which there is the potential for a high-velocity impact.

Implant removal

1. Preoperative planning

To ensure that the appropriate instruments are available for screw removal, the surgeon should have the following information before implant removal:

- Implant type
- Time of implantation
- Material
- Any visible damage to the implant (e.g. broken plate)

2. Clean recess

Before removing screws, clean the screw recess. Free the screw recess from ingrown bone and tissue to ensure the screwdriver can be fully inserted. Check the condition and geometry of the recess of the exposed screwhead.

3. Implant removal

Instruments

03.503.072	MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blade, long
311.023	Ratcheting Screwdriver Handle

To remove locking screws, ensure screwdriver blade is fully seated into the screwhead by applying some downward pressure on the screwdriver.

Slowly, turn the screwdriver counterclockwise until the screw unlocks from the plate. Then, fully remove the screw.

Note

- To remove screws with damaged recesses, refer to screw removal set with hardened drill bits.

Product information

Implants

Titanium MatrixRIB Pre-Contoured Plates

04.501.001	15 holes, for left rib 3
04.501.002	15 holes, for right rib 3
04.501.003	16 holes, for left ribs 4 and 5
04.501.004	16 holes, for right ribs 4 and 5
04.501.005	17 holes, for left ribs 6 and 7
04.501.006	17 holes, for right ribs 6 and 7
04.501.007	18 holes, for left ribs 8 and 9
04.501.008	18 holes, for right ribs 8 and 9

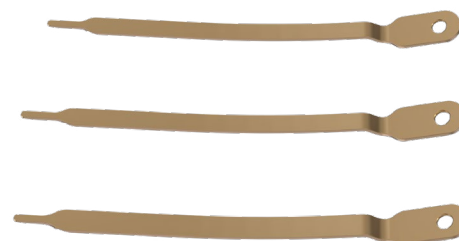


04.501.009	Titanium MatrixRIB Universal Plate, 8 holes
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Titanium MatrixRIB Intramedullary Splints

04.501.010	Small, 3 mm width
04.501.011	Medium, 4 mm width
04.501.012	Large, 5 mm width



2.7 mm Titanium MatrixRIB Locking Screws, self-drilling

04.501.208.01	8 mm
04.501.209.01	9 mm
04.501.210.01	10 mm
04.501.211.01	11 mm
04.501.212.01	12 mm
04.501.213.01	13 mm
04.501.214.01	14 mm
04.501.215.01	15 mm
04.501.216.01	16 mm
04.501.217.01	17 mm
04.501.218.01	18 mm
04.501.219.01	19 mm
04.501.220.01	20 mm



All implants are also available sterile packed. For sterile implants, add suffix "S" to article number.

Product information

Implants

2.7 mm Titanium MatrixRIB Non-locking Screws, self-drilling

04.501.250.01 10 mm

04.501.252.01 12 mm



2.9 mm Titanium MatrixRIB Locking Screws,* self-tapping

04.501.016.01 6 mm

04.501.018.01 8 mm

04.501.020.01 10 mm

04.501.022.01 12 mm

04.501.024.01 14 mm

04.501.026.01 16 mm

04.501.028.01 18 mm

04.501.030.01 20 mm



2.9 mm Titanium MatrixRIB Non-locking Screws,* self-tapping

04.501.040.01 10 mm

04.501.042.01 12 mm



1.5 mm Titanium MatrixRIB Straight Plates

04.501.096 24 holes, 240 mm length

04.501.097 30 holes, 300 mm length

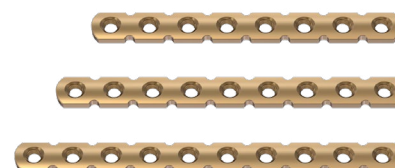


Titanium MatrixRIB Straight Plates, 2.8 mm Thick

04.501.068 8 holes

04.501.069 9 holes

04.501.095 10 holes



Titanium MatrixRIB Plates, 2.8 mm Thick

04.501.093 T Plate, 7 holes

04.501.094 I Plate, 9 holes

04.501.103 T Plate, Wide, 8 holes

04.501.104 I Plate, Wide, 11 holes



* For screws in packs of 5, replace suffix .01 with .05.

All implants are also available sterile packed. For sterile implants, add suffix "S" to article number.

Product information

Instruments

03.503.085 Depth Gauge for 2.0 mm to 3.0 mm screws with polymer handle



03.501.030 MatrixRIB Plate Holding Forceps, small, with ball tips



03.501.031 MatrixRIB Plate Holding Forceps, large, with ball tips



03.501.032 MatrixRIB Intramedullary Splint Driver



03.501.033 2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates



03.501.036–
03.501.050 MatrixRIB Drill Bit $\varnothing$ 2.2 mm with Stop, length 135/6 mm to length 135/20 mm, for J-Latch Coupling (2 mm increments)



Product information

Instruments

03.501.055 5.5 mm Drill Guide for MatrixRIB Intramedullary Splints



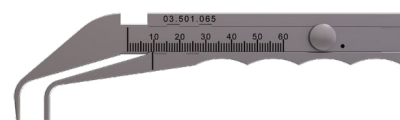
03.501.061 MatrixRIB Intramedullary Splint Template, small



03.501.062 MatrixRIB Intramedullary Splint Template, medium



03.501.065 Caliper



03.501.066 Mallet, 200 g



03.501.070 MatrixRIB Drill Bit $\varnothing$ 5.5 mm with Stop, length 125 mm, 2-flute, for J-Latch Coupling



03.501.718 Self-drilling screw guide for 1.5 mm MatrixRIB Plates



03.501.719 Self-drilling screw guide for MatrixRIB Intramedullary Splints



Product information

Instruments

03.501.085 MatrixRIB Drill Bit Ø 5.5 mm, with Stop, length 125 mm, 2-flute, for AO/ASIF Quick Coupling*



03.501.071 MatrixRIB Plate Holding Forceps, small



03.501.090 Bending Template for MatrixRIB Locking Plates, 300 mm length



03.501.074 Universal Caliper



03.501.075 5.5 mm Drill Guide for MatrixRIB Intramedullary Splints, without handle



MatrixMANDIBLE™/THORAX Self-Retaining Screwdriver Blades

03.503.071 Medium

03.503.072 Long



* Also available sterile packed. For sterile product, add suffix "S" to article number.

Product information

Instruments

311.023 Ratcheting Screwdriver Handle



03.501.091 Combination Bending Pliers for MatrixRIB



03.503.057 Shortcut Plate Cutter



398.400 Reduction Forceps with points, narrow, ratchet, 132 mm length



397.211 Universal Trocar Handle



Product information

Instruments

03.506.003 Tissue Retractor Forceps for Basic Trocar System



03.501.700 2.2 mm Threaded Drill Guide for MatrixRIB Locking Plates



03.501.702 Cannula for MatrixRIB System



03.501.703 Trocar for MatrixRIB



03.501.704 Threaded Reduction Tool for MatrixRIB System, AO Quick Coupling



03.501.708 MatrixRIB Plate Holding Forceps, upright with ball tip



03.501.709 MatrixRIB Plate Holding Forceps, large



Product information

Instruments

03.505.003 Shaft for Screwdriver 90°



03.505.004 Handle for Screwdriver 90°



03.505.005 Turning Handle for Screwdriver 90°



03.501.750 MatrixRIB Screwdriver Blade,self-holding, for Screwdriver 90°



03.501.751 MatrixRIB Drill Guide 2.2 mm for Screwdriver 90° with 0°/90° angle



03.501.752 MatrixRIB Drill Guide 2.2 mm, for Screwdriver 90° with 45°/45° angle



Product information

Instruments

MatrixRIB Drill Bits* Ø 2.2 mm, with Stop, 2-flute, for Screwdriver 90°

03.501.756	length	6 mm
03.501.758	length	8 mm
03.501.760	length	10 mm
03.501.762	length	12 mm
03.501.764	length	14 mm
03.501.766	length	16 mm
03.501.768	length	18 mm
03.501.770	length	20 mm



391.990 Cutting Pliers for Plates and Rods



03.501.715 MatrixRIB Caliper Forceps



* Also available sterile packed. For sterile product, add suffix "S" to article number.

References

1. Tanaka A, Yukioka T, Yamaguti Y, et al. Surgical stabilization of internal pneumatic stabilization? A prospective randomized study of management of severe flail chest patients. *J Trauma*. 2002;52(4):727-732; discussion 732.
2. Schüpbach P, Meier P. Indications for the reconstruction of the unstable thorax due to serial rib fractures and respiratory insufficiency [Article in German]. *Helv Chir Acta*. 1976;43(5-6):497-502.
3. Balci AE, Eren S, Cakir O, Eren MN. Open fixation in flail chest: review of 64 patients. *Asian Cardiovasc Thorac Ann*. 2004;12(1):11-15.
4. Mohr M, Abrams E, Engel C, Long WB, Bottlang M. Geometry of human ribs pertinent to orthopedic chestwall reconstruction. *J Biomech*. 2007;40:1310-1317.
5. Ciraulo DL, Elliott D, Mitchell KA, Rodriguez A. Flail chest as a marker for significant injuries. *J Am Coll Surg*. 1994;178(5):466-470.
6. Meier P, Schubach P. Therapy of the unstable thorax in serial fractures of the ribs. [In German] *Schweiz Med Wochenschr*. 1978;22;108(16):608-613.
7. Moore, BP. Operative stabilization of non-penetrating chest injuries, *J Thorac Cardiovasc Surg*. 1975;70:619-639.
8. Samarrai AR. Costosynthetic stabilization of massive chest wall instability. *Int Surg*. 1990;75(4):231-233.
9. París F, Tarazona V, Blasco E, Cantó A, Casillas M, Pastor J. Surgical stabilization of traumatic flail chest. *Thorax*. 1975;30(2):521-527.
10. Mayberry JC, Trunkey DD. The fractured rib in chest wall trauma. *Chest Surg Clin N Am*. 1997;7(2):239-61.
11. Netscher DT and Baumholtz MA. Chest reconstruction: I. Anterior and anterolateral chest wall and wounds affecting respiratory function. *Plastic Reconstr Surg*. 2009;124(5):240e-252e.

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