

# Aesculap<sup>®</sup> S4<sup>®</sup> Long Tab

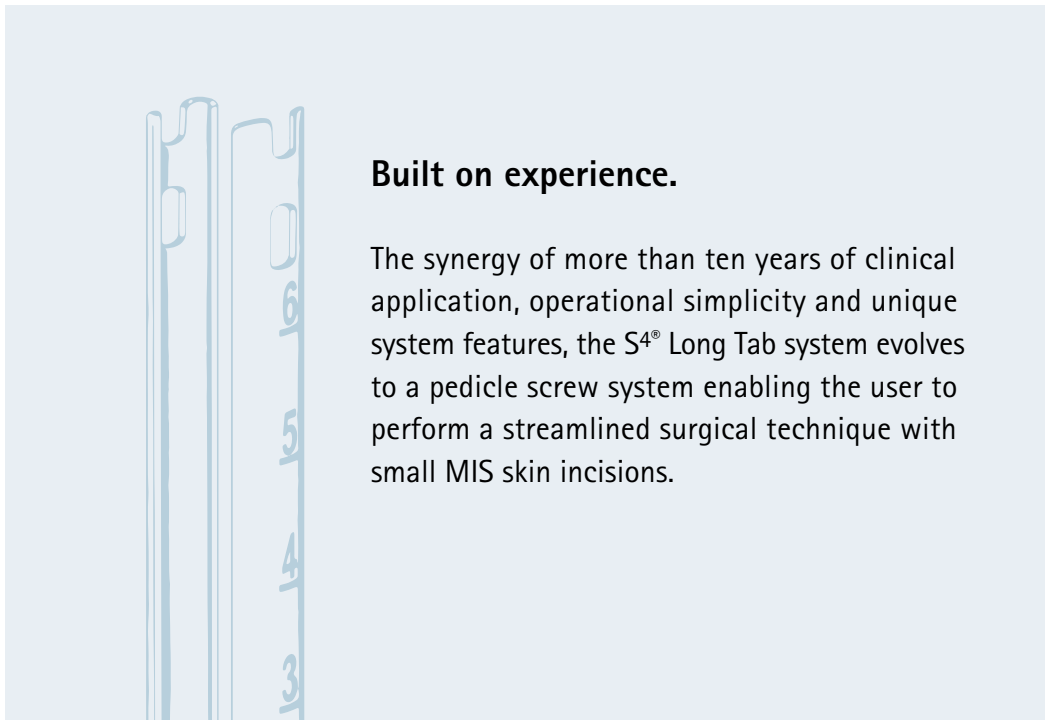
Surgical Technique



Aesculap Spine

# S4<sup>®</sup> Long Tab

Insight into MIS.



## Built on experience.

The synergy of more than ten years of clinical application, operational simplicity and unique system features, the S4<sup>®</sup> Long Tab system evolves to a pedicle screw system enabling the user to perform a streamlined surgical technique with small MIS skin incisions.



## System Features & Clinical Benefits

### Direct Visualization

- The extended blades provide a constant direct view of the surgical site without the need of additional instruments, facilitating the surgical steps and monitoring during surgery.



### Guided Rod Insertion

The system offers intuitive, streamlined instrumentation to facilitate efficiency in the OR workflow. Combined with the special MIS design of the implants, a guided rod insertion is practicable. In addition, the integrated reduction capability of the screws reduces the need for additional instrumentation.

### Lean Surgical Workflow

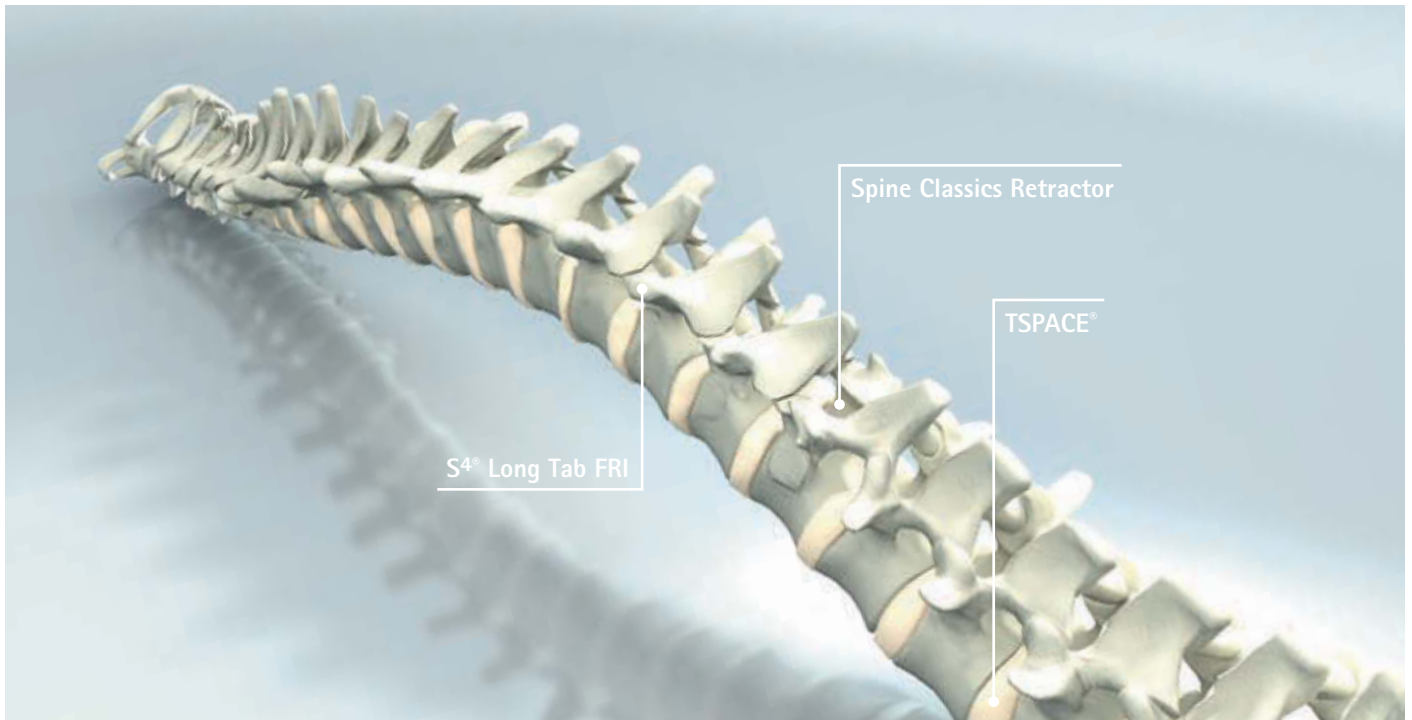
The system is based on the proven and versatile S4® platform technologies that are designed to meet the surgeons demand for a quicker yet streamlined surgical procedure.

### MIS Skin Incisions

The slim profile technology of the screw allows for a small implant design of 10.5 mm diameter and therefore for MIS skin incisions and instrument manipulation in tight anatomical spaces. Furthermore good cosmetic results can be achieved. Supported by a comprehensive spinal product portfolio the S4® Long Tab allows to provide patients all the benefits of MIS surgery.

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## Additional Treatment Options

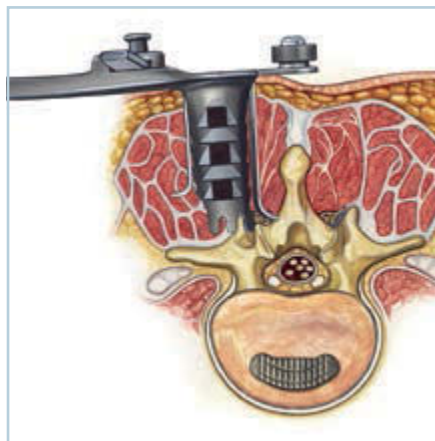


### S4<sup>®</sup> Long Tab FRI



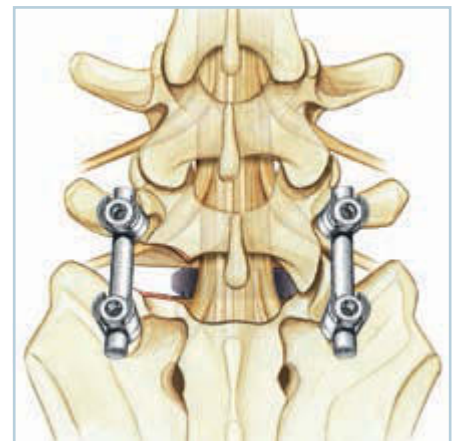
- The Fracture Reduction Instrumentation (FRI) is designed to correct dislocation of the spine caused by trauma.
- Distraction, reduction and curvature correction in all planes is accomplished with precision and control.

### Spine Classics Retractor



- The Spine Classics retractor is utilized during a microsurgical approach to retract soft tissues during lumbar discectomy procedures.
- Suitable for Interbody Fusion Devices.

### TSPACE<sup>®</sup>



- TSPACE<sup>®</sup> is the TLIF cage that has been designed to meet the requirement of the minimal-invasive surgical technique.
- Available in PEEK and Titanium.

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## S4<sup>®</sup> Long Tab

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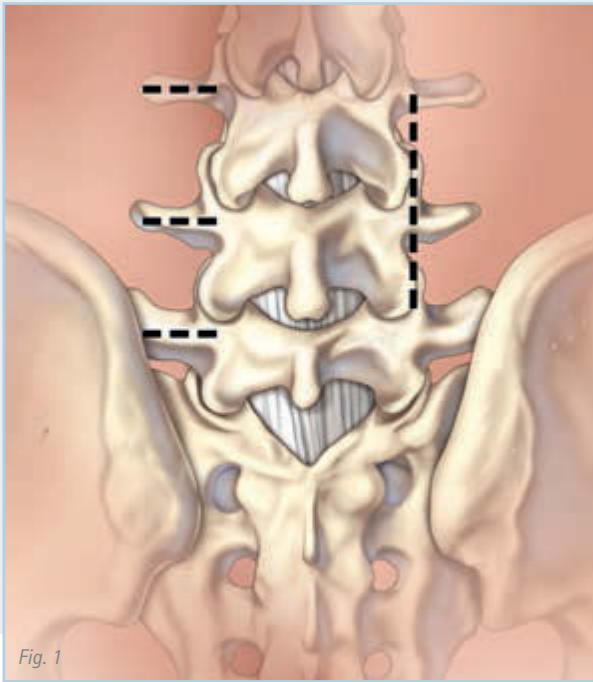
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### C Instruments – Overview

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## Surgical Technique

# A.1



### A.1. Patient Positioning, Monitoring, and Incision

- Position the patient on a radiolucent OR table in prone position. The OR table should have enough clearance for a fluoroscopic C-arm to rotate freely.
- Locate the pedicles of interest through A/P and lateral X-ray and mark appropriate incision areas on skin.
- On the ipsilateral side, make an incision of at least 10 mm at the location where each pedicle screw will be placed.
- Ensure the incision is located to allow proper trajectory for minimally invasive pedicle screw insertion.
- Ensure the fascia is cut to the same length.
- Perform the same procedure for the contralateral side.
- On the contralateral side, the mini-open TLIF technique can be used to adequately decompress and insert TLIF interbody to augment the percutaneous side.



## A.2. Pedicle Preparation

- Once the entry point of the screw has been determined the guiding instrument consisting of trocar (FW271M) and K-Wire aiming device (FW258M) is introduced at the junction of the facet and the transverse process.

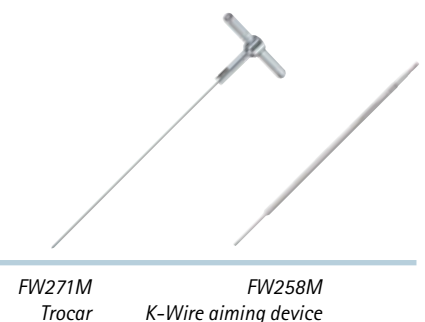
### Note:

- The K-Wire aiming device should be placed through the pedicle-vertebral body junction to facilitate the placement of the K-Wire.
- Alternatively a Jamshidi Needle can be used instead of trocar (FW271M) and K-Wire aiming device (FW258M).

- The trocar (FW271M) is removed while the K-Wire aiming device (FW258M) remains in position.

### Caution:

- Use fluoroscopy to monitor position of the trocar during insertion.
- Avoid inserting the needle too deep into the vertebral body as there is danger of perforating large vessels.



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## Surgical Technique

# A.3

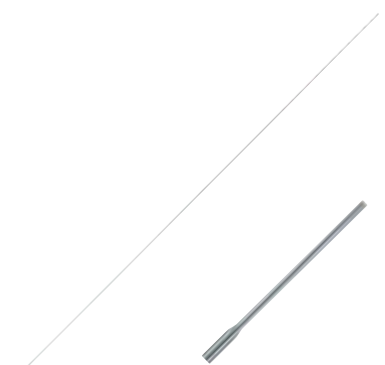


### A.3. K-Wire Insertion

- The K-Wire (FW247S) is introduced through the K-Wire aiming device (FW258M).
- The laser etchings on the K-Wire need to be placed away from the patient. Monitor the K-Wire tip to ensure it does not penetrate the anterior wall of the vertebral body.
- Repeat the steps for each K-Wire to be placed.
- In order to avoid oscillating or bending the K-Wire the K-Wire protection sleeve (FW352R) may be used.

#### Note:

- The K-Wire should be introduced in a way that its distal tip represents the end position of the pedicle screw tip. The depth of the K-Wire is essential for the determination of the screw length.



FW247S  
K-Wire

FW352R  
K-Wire protection sleeve





## A.4. Soft Tissue Dilation

- Fascia and muscle should be dilated to allow for screw placement.
- Dilate the fascia and spinal muscles by inserting the tissue dilation sleeve (FW272R) over the K-Wire aiming device (FW258M).
- Remove the K-Wire aiming device (FW258M) by using the handle (FW274M) and holding the K-Wire firmly in place.

### Note:

- The dilator should be docked on bony anatomy to minimize tissue creepage.



FW272R  
Tissue dilation sleeve



FW274M  
Handle for removal  
of FW258M

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## Surgical Technique

# A.5.



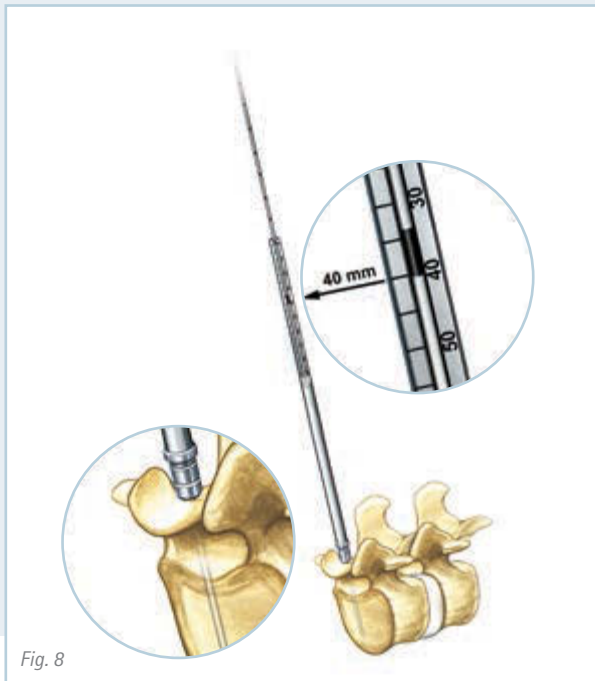
Fig. 7

### A.5. Bone Probing

- If additional bone probing is preferred, the straight cannulated bone probe (FW263R) can be used.
- Hold the K-Wire firmly and slide the cannulated bone probe (FW263R) over the K-Wire and probe to the desired depth.



FW263R  
Cannulated bone probe



## A.6. Screw Length Measuring

- Under fluoroscopic guidance, ensure the K-Wire is at an adequate depth, approximating the final screw location in the bone.
- Remove the tissue dilation sleeve (FW272R).
- Hold the K-Wire firmly and slide the screw length measuring device (FW351R) over the K-Wire.
- Read the screw length at the bottom of the widest laser marking on the K-Wire.

### Note:

- Avoid inserting the K-Wire too deep into the vertebral body as there is danger of perforating large vessels.
- The reading is an approximation, depending on the depth of the K-Wire in bone.

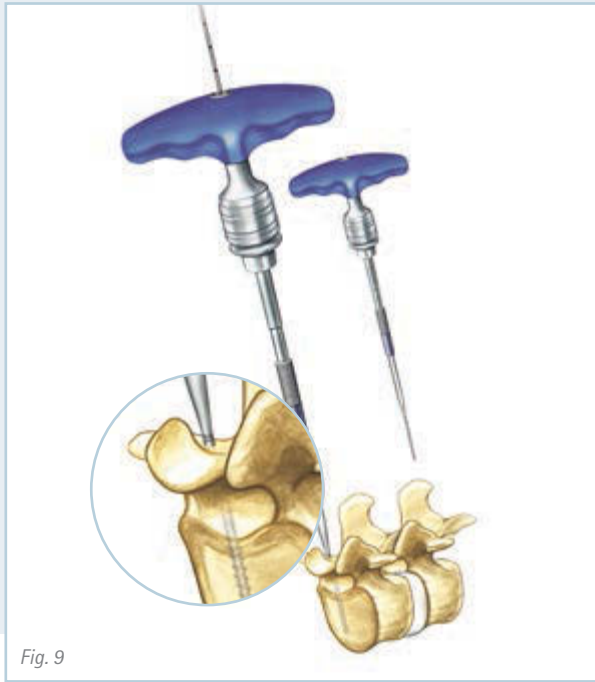


FW351R  
Screw length measuring device

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## Surgical Technique

# A.7



### A.7. Tapping Pedicle

- If additional bone tapping is preferred, the screw taps can be used.
- To tap, attach either the straight ratchet handle (FW165R) or t-shaped ratchet handle (FW167R) to the appropriate screw tap based on the corresponding screw diameter.

#### Note:

- The included screw taps range from 4.5 to 6.5 mm in 1 mm increments and each are undersized by 0.5 mm.



FW165R  
Straight ratchet handle



FW167R  
T-shaped ratchet handle



FW714R – FW716R  
Screw taps



### A.8. Screw Placement

- After the preparation of the pedicle channel and the determination of the proper screw length, the screw may be prepared for placement.
- Orient the tab protection ring (FW739R) with the notch facing up.
- Place the tab protection ring (FW739R) onto the screw tabs, such that the ring snaps into the attachment holes of the screw tabs.



FW739R  
Tab protection ring

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## Surgical Technique

# A.8.



### A.8. Screw Placement

- Attach either the straight ratchet handle (FW165R) or t-shaped ratchet handle (FW167R) to the screw driver (FW731R).
- To place a polyaxial screw, first fully engage the hexagonal tip of the screw driver into the head of the screw. The marking on the screw driver indicates if the screw is engaged correctly.
- Slide the assembled screw and driver assembly over the K-Wire.
- Insert the screw to the appropriate depth. If needed, fluoroscopic guidance can be used.
- Remove the K-Wire after an appropriate amount of bone purchase is established to avoid driving the K-Wire into a vertebral artery.
- Once the screw is fully inserted, remove the screw driver from the screw.
- Repeat the steps for all subsequent screws.

#### Note:

- If the polyaxicity of the screw remains, the screw driver is not fully engaged.



FW731R  
Screw driver

# A.9



## A.9. Rod Length Measuring

- The rod length measuring instrument (FW729R) is used to approximate necessary rod length.
- Place the sliding gauge over the scale of the rod length measuring instrument.

- Fully seat the pins into the tab protection rings (FW739R) of the most cranial and caudal screws while keeping both screws parallel.
- The etched scale on top of the length measuring instrument indicates the minimum recommended rod length.

### Note:

- The rod trial (FW185R) is an alternative for approximating rod length and rod bend.
- Lay the rod trial into the notches of the tab protection rings while the screws are kept parallel.
- Bend the trial accordingly to ensure all portions are in close contact with the notches of the tab protection rings prior to reading the scale.



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## Surgical Technique

# A.10.

### A.10. Aligning Screws for Rod Insertion

- Once the rod measurements are taken, align the notches of the tab protection rings (FW739R).
- If needed, the orientation of the screw body can be changed by rotating the tab protection rings to the desired position.





Fig. 15



Fig. 16

## A.11. Rod Insertion

- Assemble the inner shaft of the rod inserter (FW711R) to the main body by fully engaging the shaft.
- The minimally invasive rod has a bullet tip to ease passage through soft tissue and a hex end geometry to engage with the rod inserter (FW711R).
- Unscrew the knob of the inner shaft of the rod inserter and slide in the hex end into the distal opening of the instrument.
- Firmly tighten the inner shaft clockwise to secure the rod in place.
- Guide the rod down through the longitudinal slots of the screws.

### Note:

- The inner shaft of the rod inserter must be firmly tightened to prevent premature in-situ release of the rod.
- Ensure that the tab protection rings are placed on the screws during rod insertion.
- The distal connection part of the rod inserter will not fit through the tabs. Use caution during rod insertion in order to prevent the application of force to the tabs. Do not perform leverage maneuvers during rod insertion.



FW711R  
Rod inserter

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## Surgical Technique

# A.12



Fig. 17

### A.12. Set Screw Insertion

- The self-retaining set screw starter (FW733R) may be used to obtain a set screw from the storage disc.
- The hex of the instrument is aligned with the hex on the set screw, and the instrument is then pushed into the set screw to secure the connection.
- Thread the set screw into the screw body until it touches the rod. The marking on the set screw starter indicates if the set screw is engaged completely.
- The built-in reduction thread of the blades allow for approximately 12 mm of rod reduction.

#### Note:

- In order to facilitate the insertion of the set screw, the rod can be pushed down by using either the FRI outer sleeve (FW737R) or the counter-torque instrument (FW728R). The tab protection ring has to be removed prior using the FRI outer sleeve or the counter-torque instrument.
- Do not over tighten the set screw. A torque wrench along with a counter-torque should be used for final tightening.



FW728R  
Counter-torque instrument

FW737R  
FRI outer sleeve

FW733R  
Set screw starter

# A.13.



## A.13. Final Tightening – after Stabilization

- If no reduction is necessary the next step is fully tighten the construct. In case of reduction, the steps are described in chapter A.14.
- Remove the tab protection ring (FW739R) from the screw tabs.
- If additional reduction is needed, the counter-torque instrument (FW728R) can be used to push the rod down into the screw head after the tab protection ring is removed.



FW728R  
Counter-torque instrument

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## Surgical Technique



Fig. 20



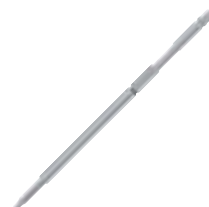
Fig. 21

### A.13. Final Tightening – after Stabilization

- Assemble the torque wrench handle (NE160R) by attaching the torque wrench shaft (FW732R).
- Slide the counter-torque instrument (FW728R) over the screw tabs.
- Insert the torque wrench assembly through the counter-torque instrument into the screw and engage the set screw. The marking on the torque wrench shaft indicates if it is engaged correctly on the set screw.
- Tighten the torque wrench handle while maintaining the counter-torque with the counter-torque instrument in place until an audible click is heard.

#### Note:

- Ensure the tip of the torque wrench is fully seated into the set screw during final torque.
- Only tighten the set screw to the specified setting of 10 Nm (90/in/lbs). Over tightening will lead to damaging of the implant and could lead to implant failure.
- Never use the torque limiting wrench without the counter-torque instrument.
- If damaged, set screws must be replaced.



FW732R  
Torque wrench shaft



NE160R  
Torque wrench handle

# A.13.

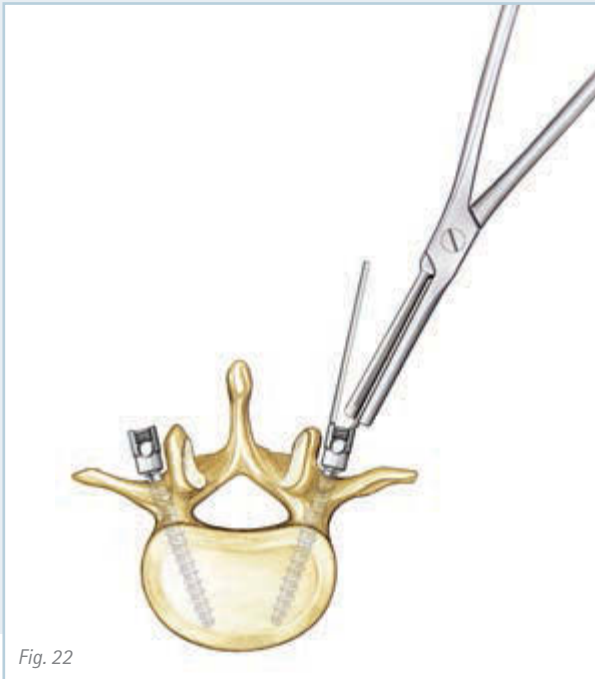


Fig. 22

- After tightening all set screws, turn the knob of the inner shaft of the rod inserter counter-clockwise.
- Pull the rod inserter away from the construct in order to disengage the rod inserter from the rod.
- Disengage the instruments from the construct and remove the tabs with tab breaker (FW738R).

#### Note:

- Ensure all set screws in the construct are fully tightened.



FW738R  
Tab breaker

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## Surgical Technique

# A.14.



### A.14. Reduction

- Remove the tab protection rings (FW739R) from the screw tabs.
- Slide the FRI outer sleeve (FW737R) over the screw tabs. The marking on the FRI outer sleeve shows if the rod is fully seated on the screw body.

#### Note:

- The torque wrench shaft (FW732R) may be used as a guidance for the proper placement of the FRI outer sleeve.



FW737R  
FRI outer sleeve

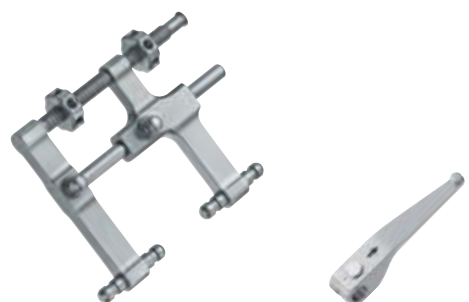
# A.14.1



Fig. 24

## A.14.1. Assembly of Parallel Distractor

- Place the first distraction nut on the rear parallel guide of the frame (A).
- Position the free distraction portion (B) on the parallel guide.
- Place the second distraction nut on the rear parallel guide.
- Attach the distractor blades (FW706R) (C) on the connection parts of the frame (FW238R).



FW238R  
FRI distractor

FW706R  
Distractor blades, small

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## Surgical Technique

# A.14.2



### A.14.2. Distraction

- The distractor (consisting of FW238R and FW706R) is fixed to the cranial and caudal FRI outer sleeves by sliding the pins down the guiding groove.
- Repeat this process on the contra-lateral side.

#### Note:

- The distraction arms must be inserted parallel to the FRI outer sleeve.

- Distraction can be carried out via the distraction nuts.
- Distraction can be changed in very small increments by rotating the distraction nut.
- The opposing nut can be set to prevent over-distraction.

#### Note:

- If preferred, distraction may take place under fluoroscopic control.



# A.14.3.



Fig. 27

## A.14.3. Lordosis Correction

- If needed, the correction of the lordosis can be carried out.
- The attachment (A) is placed on the spindle (B) with the pivot inward and fixed with the distraction nut (C).



FW709R  
Distance holder

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## Surgical Technique

# A.14.3.



Fig. 28



Fig. 29

### A.14.3. Lordosis Correction

- If necessary, the natural lordosis can be restored with the distance holder (FW709R).
- The pins of the spindle are inserted into the groove on the upper part of the FRI outer sleeve (FW737R).
- Repeat this process on the contra-lateral side.

#### Note:

- The spindle distractor must be placed parallel to the FRI outer sleeve to avoid tilting.

- Lordosis can be corrected using the distraction nut.
- The distraction nut can be manipulated by hand or with the fixation nut wrench (FW237R).

#### Note:

- Verify if the rod is positioned correctly in the screw head; the end of the screw tabs must be at the same level as the marking on the FRI outer sleeves (FW737R).



FW237R  
Fixation nut wrench

FW709R  
Distance holder

# A.14.4



Fig. 30



Fig. 31

## A.14.4. Final Tightening – after Reduction

- Assemble the torque wrench handle (NE160R) by attaching the torque wrench shaft (FW732R).
- Insert the torque wrench handle through the FRI outer sleeve into the screw and engage the set screw.
- Attach the counter-torque (FW236R) to the hexagonal protrusion of the FRI outer sleeve (FW737R).
- Tighten the torque wrench handle while maintaining the counter-torque with the counter-torque instrument in place until an audible click is heard.
- After tightening all set screws, turn the knob of the inner shaft of the rod inserter counter-clockwise.
- Pull the rod inserter away from the construct in order to disengage the rod inserter from the rod.
- Disengage the instruments from the construct and remove the tabs with tab breaker (FW738R).

### Note:

#### Note:

- Only tighten the set screw (SW790T) to the specified setting of 10 Nm (90/in/lbs). Over tightening will lead to damaging of the implant and could lead to implant failure.
- Never use the torque limiting wrench without the counter-torque instrument.
- If damaged, set screws must be replaced.



FW738R  
Tab breaker

FW236R  
Counter-torque

FW732R  
Torque wrench shaft

NE160R  
Torque wrench handle

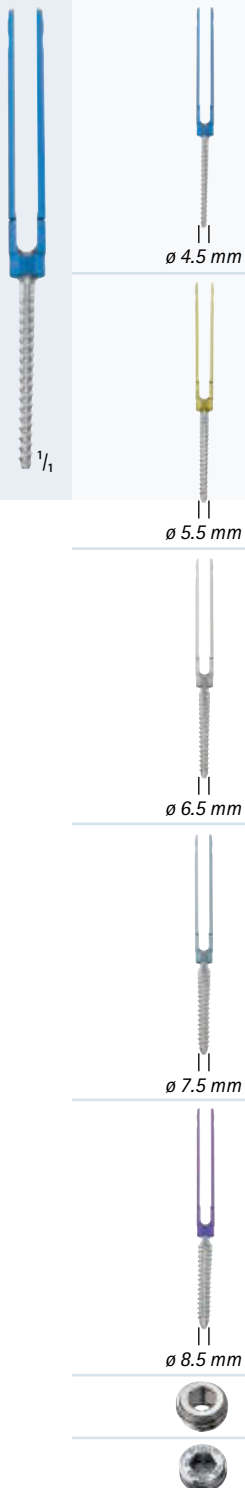
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## Implants – Overview

B.1

### Screws

#### S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated



SX545T	<b>S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm</b>	4.5 x 25 mm
SX563T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm	4.5 x 30 mm
SX564T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm	4.5 x 35 mm
SX565T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm	4.5 x 40 mm
SX566T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm	4.5 x 45 mm
SX567T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 4.5 mm	4.5 x 50 mm
SX573T	<b>S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 5.5 mm</b>	5.5 x 30 mm
SX574T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 5.5 mm	5.5 x 35 mm
SX575T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 5.5 mm	5.5 x 40 mm
SX576T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 5.5 mm	5.5 x 45 mm
SX577T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 5.5 mm	5.5 x 50 mm
SX584T	<b>S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 6.5 mm</b>	6.5 x 35 mm
SX585T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 6.5 mm	6.5 x 40 mm
SX586T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 6.5 mm	6.5 x 45 mm
SX587T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 6.5 mm	6.5 x 50 mm
SX588T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 6.5 mm	6.5 x 55 mm
SX594T	<b>S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 7.5 mm</b>	7.5 x 35 mm
SX595T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 7.5 mm	7.5 x 40 mm
SX596T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 7.5 mm	7.5 x 45 mm
SX597T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 7.5 mm	7.5 x 50 mm
SX598T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 7.5 mm	7.5 x 55 mm
SX604T	<b>S4<sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 8.5 mm</b>	8.5 x 35 mm
SX605T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 8.5 mm	8.5 x 40 mm
SX606T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 8.5 mm	8.5 x 45 mm
SX607T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 8.5 mm	8.5 x 50 mm
SX608T	S4 <sup>®</sup> Long Tab Polyaxial Screw, cannulated, Ø 8.5 mm	8.5 x 55 mm
SW375T	Set Screw, cannulated	
SW790T	Set Screw, not cannulated	

## Rods

**S4° Rod with hexagonal connection, pre-bent, ø 5.5 mm**




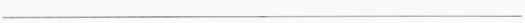









SW554T	with tip and hexagonal connection	5.5 x 35 mm
SW555T	with tip and hexagonal connection	5.5 x 40 mm
SW556T	with tip and hexagonal connection	5.5 x 45 mm
SW557T	with tip and hexagonal connection	5.5 x 50 mm
SW558T	with tip and hexagonal connection	5.5 x 55 mm
SW559T	with tip and hexagonal connection	5.5 x 60 mm
SW561T	with tip and hexagonal connection	5.5 x 70 mm
SW562T	with tip and hexagonal connection	5.5 x 80 mm
SW563T	with tip and hexagonal connection	5.5 x 90 mm
SW564T	with tip and hexagonal connection	5.5 x 100 mm
SW566T	with tip and hexagonal connection	5.5 x 110 mm
SW567T	with tip and hexagonal connection	5.5 x 120 mm

**S4° Rod with hexagonal connection, straight, ø 5.5 mm**

SW573T	with tip and hexagonal connection	5.5 x 35 mm
SW574T	with tip and hexagonal connection	5.5 x 40 mm
SW576T	with tip and hexagonal connection	5.5 x 45 mm
SW577T	with tip and hexagonal connection	5.5 x 50 mm
SW578T	with tip and hexagonal connection	5.5 x 55 mm
SW579T	with tip and hexagonal connection	5.5 x 60 mm
SW581T	with tip and hexagonal connection	5.5 x 70 mm
SW582T	with tip and hexagonal connection	5.5 x 80 mm
SW583T	with tip and hexagonal connection	5.5 x 90 mm
SW584T	with tip and hexagonal connection	5.5 x 100 mm
SW585T	with tip and hexagonal connection	5.5 x 110 mm
SW586T	with tip and hexagonal connection	5.5 x 120 mm
SW587T	with tip and hexagonal connection	5.5 x 150 mm
SW588T	with tip and hexagonal connection	5.5 x 180 mm
SW589T	with hexagonal connection	5.5 x 200 mm
SW590T	with hexagonal connection	5.5 x 300 mm
SW591T	with hexagonal connection	5.5 x 400 mm
SW592T	with hexagonal connection	5.5 x 500 mm

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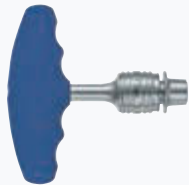
## Instruments – Overview

Pedicle Preparation		
Item No.	Description	
	FW271M	Trocar
	FW258M	K-Wire Aiming Device
	FW274M	Handle for removal of FW258M
	FW247S	K-Wire
	FW352R	K-Wire Protection Sleeve
	FW243R	Slotted Hammer
Bone Awl		
Item No.	Description	
	FW263R	Cannulated Bone Probe
Tissue Dilator		
Item No.	Description	
	FW272R	Tissue Dilation Sleeve
Screw Length Measuring		
Item No.	Description	
	FW351R	Screw Length Measuring Device
Screw Taps		
Item No.	Description	
	FW714R	MIS Screw Tap for Cannulated Screws, Ø 4.5mm
	FW715R	MIS Screw Tap for Cannulated Screws, Ø 5.5mm
	FW716R	MIS Screw Tap for Cannulated Screws, Ø 6.5mm
	FW692R	Percutaneous Cleaning Device

**Handles****Item No.****Description**

FW165R

Straight Ratchet Handle



FW167R

T-shaped Ratchet Handle

**Screw Placement****Item No.****Description**

FW739R

Tab Protection Ring



FW731R

Screw Driver

**Rod Length Measuring****Item No.****Description**

FW729R

Rod Length Measuring Instrument



FW185R

Rod Trial

**Rod Insertion****Item No.****Description**

FW711R

Rod Inserter



FW024R

Rod Bending Forceps Adjustable

# S4<sup>®</sup> Long Tab

## Instruments – Overview

### Set Screw Placement



Item No.

Description

FW733R

Set Screw Starter

### Reduction

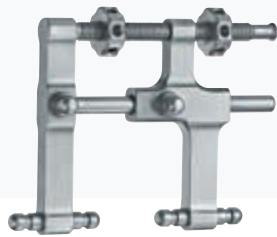


Item No.

Description

FW737R

FRI Outer Sleeve



FW238R

FRI Distractor



FW706R

Distractor Blades, small



FW709R

Distance Holder



FW237R

Fixation Nut Wrench



**Torque / Counter-Torque****Item No.****Description**

FW728R

Counter-Torque Instrument



NE160R

Torque Wrench Handle



FW732R

Torque Wrench Shaft



FW236R

Counter-Torque Handle

**Tab Breaking****Item No.****Description**

FW738R

Tab Breaker

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## Notes



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