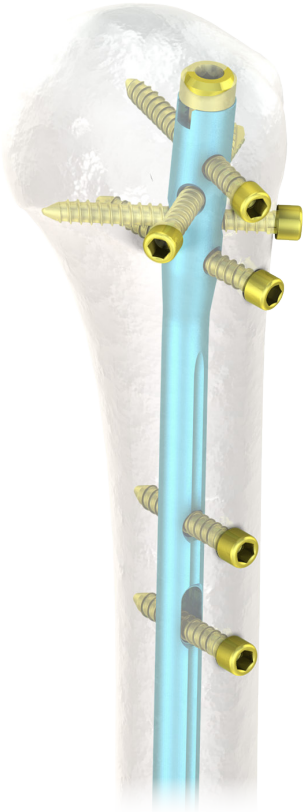
ST/04G

CHM®

CHARFIX system

INTRAMEDULLARY OSTEOSYNTHESIS OF HUMERUS

- *IMPLANTS*
- *INSTRUMENT SET 40.5020.500*
- *SURGICAL TECHNIQUE*



www.chm.eu

SYMBOLS DESCRIPTION

Ti	Pure titanium
TiA	Titanium alloy
St	Steel
L	Left
R	Right
L R	Available versions: left/right
Len	Length
	Torx drive
	Torx drive cannulated
	Hexagonal drive
	Hexagonal drive cannulated
	Cannulated
	Locking
	Diameter
	Inner diameter
	Recommended length range for a particular nail
	Angle
16 ÷ 90	Available lengths
Ster Non Ster	Available in sterile/ non- sterile condition

	Caution - pay attention to a special procedure.
	Perform the activity under X-Ray control.
	Information about the next stages of a procedure.
	Proceed to the next stage.
	Return to the specified stage and repeat the activity.
	Before using the product, carefully read the Instructions for Use. It contains, among others, indications, contraindications, side effects, recommendations and warnings related to the use of the product.
	The above description is not a detailed instruction of conduct. The surgeon decides about choosing the operating procedure.

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Document No ST/04G
Date of issue 02.08.2010
Review date P-009-24.11.2022

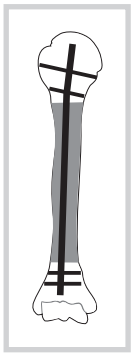
The manufacturer reserves the right to introduce design changes.

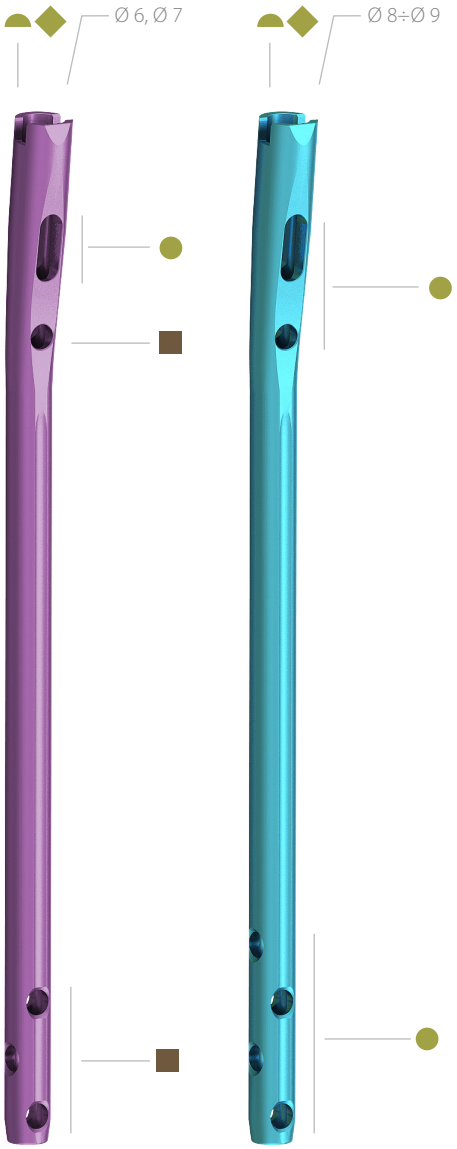
Updated INSTRUCTIONS FOR USE are available at the following website: ifu.chm.eu

I. IMPLANTS

CHARFIX COMPRESSION HUMERAL NAIL

CHARFIX system





Ster
Non Ster

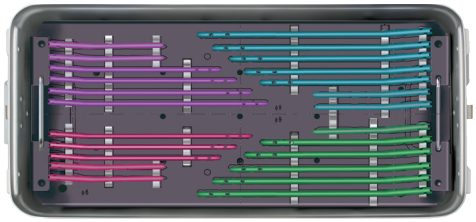
	Len	TiA
6	180	3.2383.180
	200	3.2383.200
	220	3.2383.220
	240	3.2383.240
	260	3.2383.260
	280	3.2383.280
	300	3.2383.300
	320	3.2383.320
7	180	3.2384.180
	200	3.2384.200
	220	3.2384.220
	240	3.2384.240
	260	3.2384.260
	280	3.2384.280
	300	3.2384.300
	320	3.2384.320
8	180	3.2095.180
	200	3.2095.200
	220	3.2095.220
	240	3.2095.240
	260	3.2095.260
	280	3.2095.280
	300	3.2095.300
	320	3.2095.320
9	180	3.2096.180
	200	3.2096.200
	220	3.2096.220
	240	3.2096.240
	260	3.2096.260
	280	3.2096.280
	300	3.2096.300
	320	3.2096.320

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	180 mm ÷ 400 mm		5 mm

	TiA					
	3.1654.xxx	✓			4.5	25÷80
	3.1655.xxx	✓			3.5	20÷70
	3.2106.004	✓				
	3.2104.5xx	✓		✓		0÷5

St

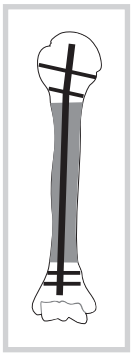


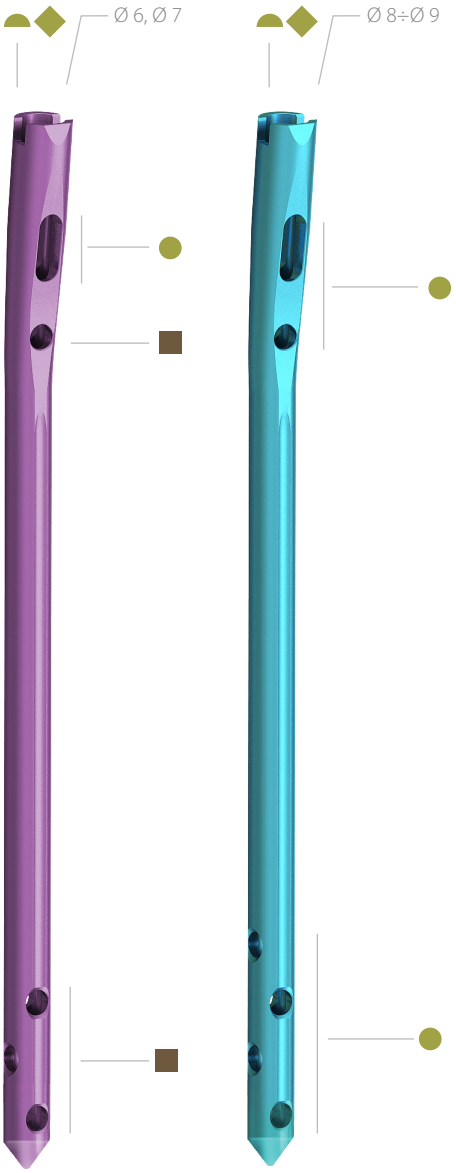
Stand for humeral nails (implants not included) 40.5751.000

ChM sp. z o.o., Lewickie 3b, 16-061 Juchnowiec Kościelny, POLAND, tel. + 48 85 86 86 100, fax + 48 85 86 86 101, chm@chm.eu, www.chm.eu

CHARFIX COMPRESSION HUMERAL NAIL

CHARFIX system





Ster
Non Ster

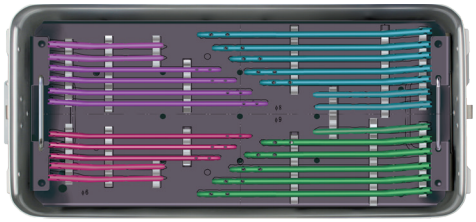
	Len	TiA
6	180	3.2099.180
	200	3.2099.200
	220	3.2099.220
	240	3.2099.240
	260	3.2099.260
	280	3.2099.280
	300	3.2099.300
	320	3.2099.320
7	180	3.2100.180
	200	3.2100.200
	220	3.2100.220
	240	3.2100.240
	260	3.2100.260
	280	3.2100.280
	300	3.2100.300
	320	3.2100.320
8	180	3.2097.180
	200	3.2097.200
	220	3.2097.220
	240	3.2097.240
	260	3.2097.260
	280	3.2097.280
	300	3.2097.300
	320	3.2097.320
9	180	3.2098.180
	200	3.2098.200
	220	3.2098.220
	240	3.2098.240
	260	3.2098.260
	280	3.2098.280
	300	3.2098.300
	320	3.2098.320

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	180 mm ÷ 400 mm		5 mm

	TiA					
	3.1654.xxx	✓			4.5	25÷80
	3.1655.xxx	✓			3.5	20÷70
	3.2106.004	✓				
	3.2104.5xx	✓		✓		0÷5

St



Stand for humeral nails (implants not included) 40.5751.000

LOCKING ELEMENTS

Ster
Non Ster

CHARFIX system

CHARFIX DISTAL SCREW 4.5

TiA

25	3.1654.025
30	3.1654.030
35	3.1654.035
40	3.1654.040
45	3.1654.045
50	3.1654.050
55	3.1654.055
60	3.1654.060
65	3.1654.065
70	3.1654.070
80	3.1654.080

25 ÷ 80

St

CHARFIX DISTAL SCREW 3.5

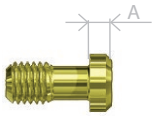
TiA

20	3.1655.020
25	3.1655.025
30	3.1655.030
35	3.1655.035
40	3.1655.040
45	3.1655.045
50	3.1655.050

20 ÷ 70

St

CHARFIX END CAP M7



TiA

A	
0	3.2104.500
+5	3.2104.505

St

CHARFIX COMPRESSION SCREW M7x1

TiA

	3.2106.004

St

Stand for CHARFIX nail locking elements (set with a box without implants) 40.4686.200

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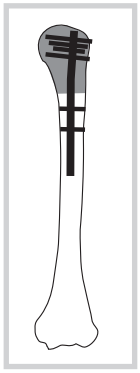
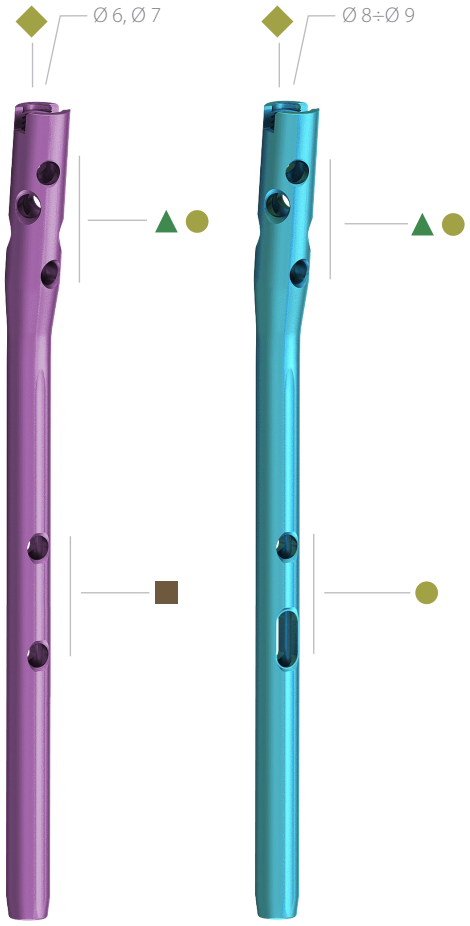
CHARFIX RECONSTRUCTION HUMERAL NAIL

CHARFIX system





Ster
Non Ster

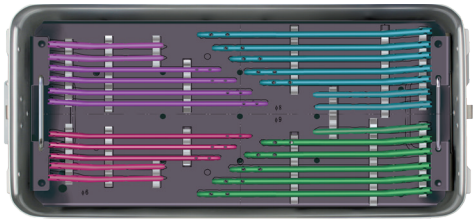
Len	TiA
6	3.2430.150
7	3.2432.150
8	3.2434.150
9	3.2436.150
150	

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	150 mm ÷ 200 mm		5 mm

	TiA					
	3.1657.xxx	✓	✓		5.0	30÷70
	3.1654.xxx	✓			4.5	25÷80
	3.1655.xxx	✓			3.5	20÷50
	3.2104.2xx	✓		✓		0÷5

St



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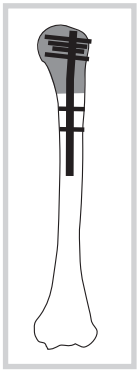
CHARFIX RECONSTRUCTION HUMERAL NAIL

CHARFIX system



Ster
Non Ster

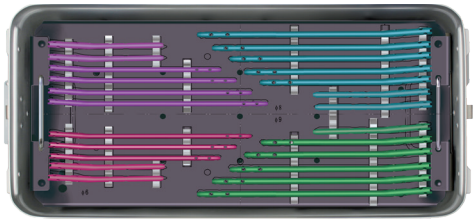
Len	TiA
6	3.2450.150
7	3.2452.150
8	3.2454.150
9	3.2456.150
150	

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	150 mm ÷ 200 mm		5 mm

	TiA					
	3.1657.xxx	✓	✓		5.0	30÷70
	3.1654.xxx	✓			4.5	25÷80
	3.1655.xxx	✓			3.5	20÷50
	3.2104.2xx	✓		✓		0÷5

St



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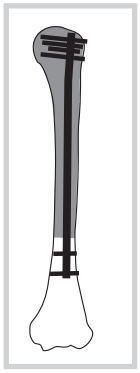
CHARFIX RECONSTRUCTION HUMERAL NAIL

CHARFIX system



Ster
Non Ster

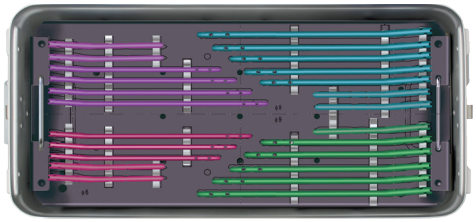
Len	TiA
6	200 — 3.2431.200
	220 — 3.2431.220
	240 — 3.2431.240
	260 — 3.2431.260
	280 — 3.2431.280
	300 — 3.2431.300
	320 — 3.2431.320
7	200 — 3.2433.200
	220 — 3.2433.220
	240 — 3.2433.240
	260 — 3.2433.260
	280 — 3.2433.280
	300 — 3.2433.300
	320 — 3.2433.320
8	200 — 3.2435.200
	220 — 3.2435.220
	240 — 3.2435.240
	260 — 3.2435.260
	280 — 3.2435.280
	300 — 3.2435.300
	320 — 3.2435.320
9	200 — 3.2437.200
	220 — 3.2437.220
	240 — 3.2437.240
	260 — 3.2437.260
	280 — 3.2437.280
	300 — 3.2437.300
	320 — 3.2437.320

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	200 mm ÷ 400 mm		5 mm

	TiA					
	3.1657.xxx	✓	✓		5.0	30÷70
	3.1654.xxx	✓			4.5	25÷80
	3.1655.xxx	✓			3.5	20÷50
	3.2104.2xx	✓		✓		0÷5

St



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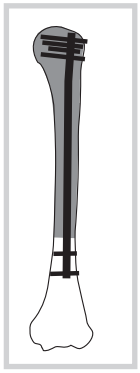
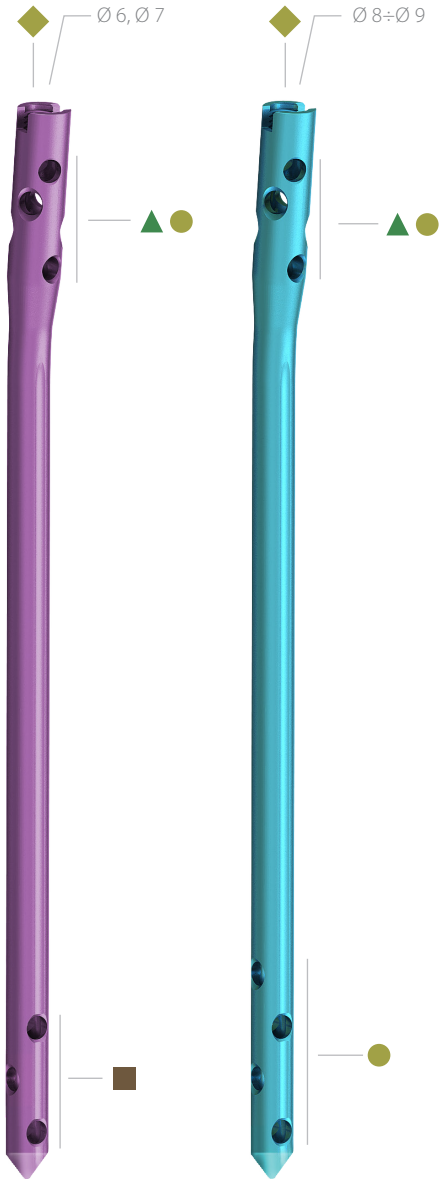
CHARFIX RECONSTRUCTION HUMERAL NAIL

CHARFIX system





Ster
Non Ster

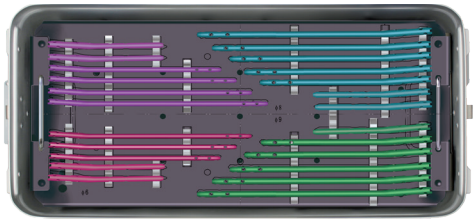
Len	TiA
6	200 3.2451.200
	220 3.2451.220
	240 3.2451.240
	260 3.2451.260
	280 3.2451.280
	300 3.2451.300
	320 3.2451.320
7	200 3.2453.200
	220 3.2453.220
	240 3.2453.240
	260 3.2453.260
	280 3.2453.280
	300 3.2453.300
	320 3.2453.320
8	200 3.2455.200
	220 3.2455.220
	240 3.2455.240
	260 3.2455.260
	280 3.2455.280
	300 3.2455.300
	320 3.2455.320
9	200 3.2457.200
	220 3.2457.220
	240 3.2457.240
	260 3.2457.260
	280 3.2457.280
	300 3.2457.300
	320 3.2457.320

St

available	Ø	6 mm ÷10 mm	pitch	1 mm
	L	200 mm ÷ 400 mm		5 mm

TiA					
3.1657.xxx	✓	✓		5.0	30÷70
3.1654.xxx	✓			4.5	25÷80
3.1655.xxx	✓			3.5	20÷50
3.2104.2xx	✓		✓		0÷5

St



Stand for humeral nails (implants not included) 40.5751.000

LOCKING ELEMENTS

TiA | Ster Non Ster

CHARFIX system

CHARFIX DISTAL SCREW 4.5

25	3.1654.025
30	3.1654.030
35	3.1654.035
40	3.1654.040
45	3.1654.045
50	3.1654.050
55	3.1654.055
60	3.1654.060
65	3.1654.065
70	3.1654.070
80	3.1654.080

25 ÷ 80

St

CHARFIX DISTAL SCREW 3.5

20	3.1655.020
25	3.1655.025
30	3.1655.030
35	3.1655.035
40	3.1655.040
45	3.1655.045
50	3.1655.050

20 ÷ 50

St

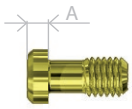
CHARFIX DISTAL SCREW 5.0

30	3.1657.030
35	3.1657.035
40	3.1657.040
45	3.1657.045
50	3.1657.050
55	3.1657.055
60	3.1657.060
65	3.1657.065
70	3.1657.070

30 ÷ 70

St

CHARFIX END CAP M7



A	
0	3.2104.200
+5	3.2104.205

St

Stand for CHARFIX nail locking elements (set with a box without implants) 40.4686.200

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II. INTRODUCTION

CHARFIX system - INTRAMEDULLARY OSTEOSYNTHESIS OF HUMERUS, consists of:
- Implants *(intramedullary nail, locking screws, end cap or compression screw)*,
- Instrument set for implant insertion and removal when the treatment has been completed,
- Instructions for use *(surgical technique)*.

Intramedullary osteosynthesis of humerus provides stable fixation in the following cases:
- comminuted fractures of the shaft of the humerus,
- severe closed and open fractures of I degree,
- pathological fractures, mal-union or non-union of the fragments of the humeral shaft after treatment using other methods.

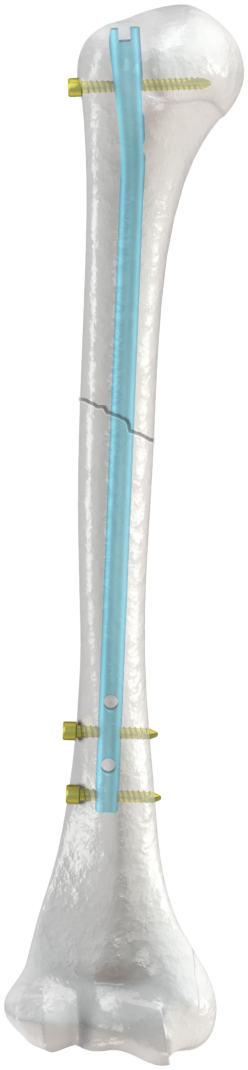
CHARFIX system provides the following methods of intramedullary fixation:

Static method

Static fixation is used in multi-fragmental fractures with non-axial stability of bone fragments.
Use holes in the distal part of the nail, and one round or both holes - round and oval-shaped - in the proximal part to lock the nail statically.

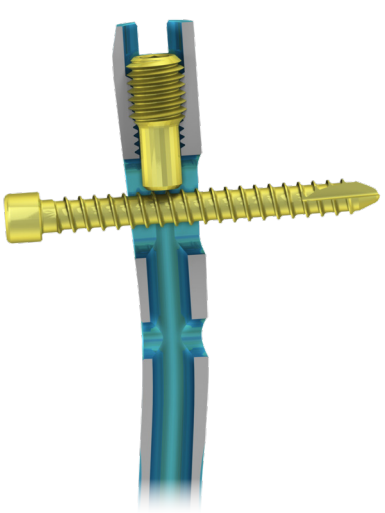
Dynamic method

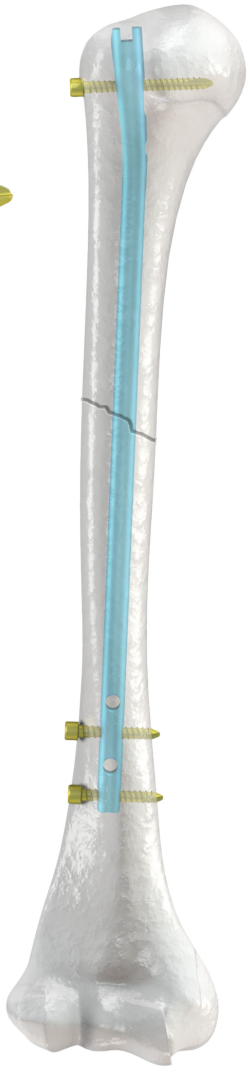
Dynamic fixation may be used in the case of good cortex contact of bone fragments in transverse and oblique fractures, as well as in pseudoarthroses. All distal holes and one oval-shaped proximal hole of the intramedullary humeral nail are used in that fixation.
Dynamic fixation enables axial movement of bone fragments while loading the limb. In this way, a physiological stimulus is formed to create to create callus and transform it into the lamellar bone.



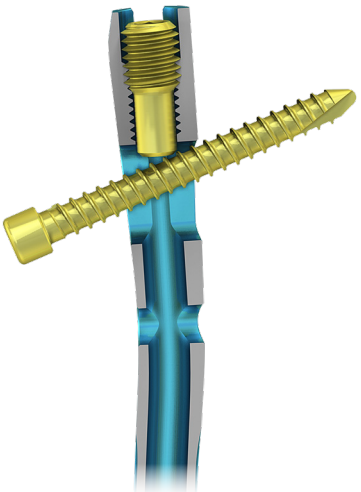
Dynamic method with compression

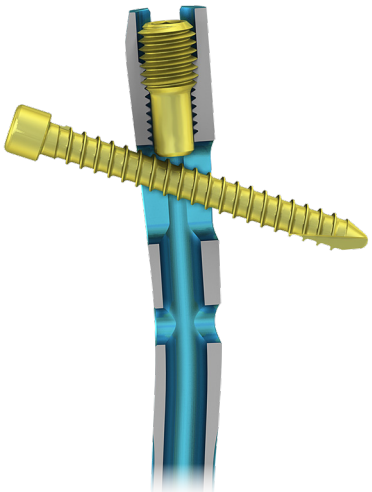
In dynamic fixation with compression *(compressive fixation)* the compression screw shall be axially inserted into internal threaded hole of the nail shaft in order to put pressure on the screw that locks the nail. The compressive fixation eliminates all micro-movements in the initial stage of fracture treatment.





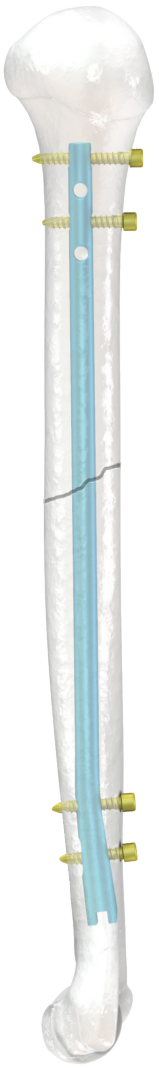
Oblique locking of the nail





Distal insertion of the nail

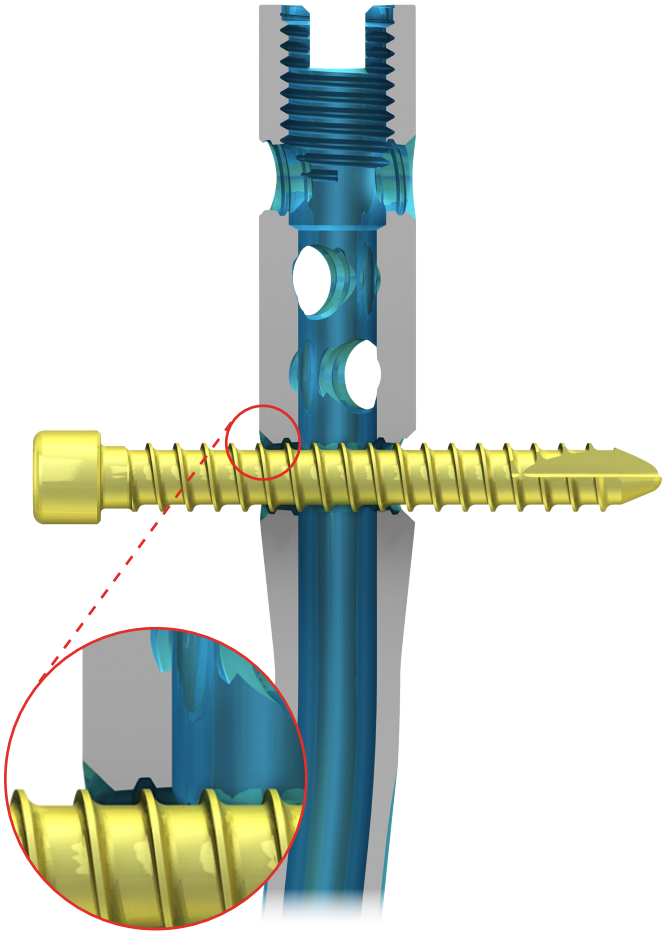
Humeral bone fractures located in the shaft, metaphysis and epiphysis of humeral bone may be also reduced using intramedullary **ChM** nail inserted from the distal epiphysis area.



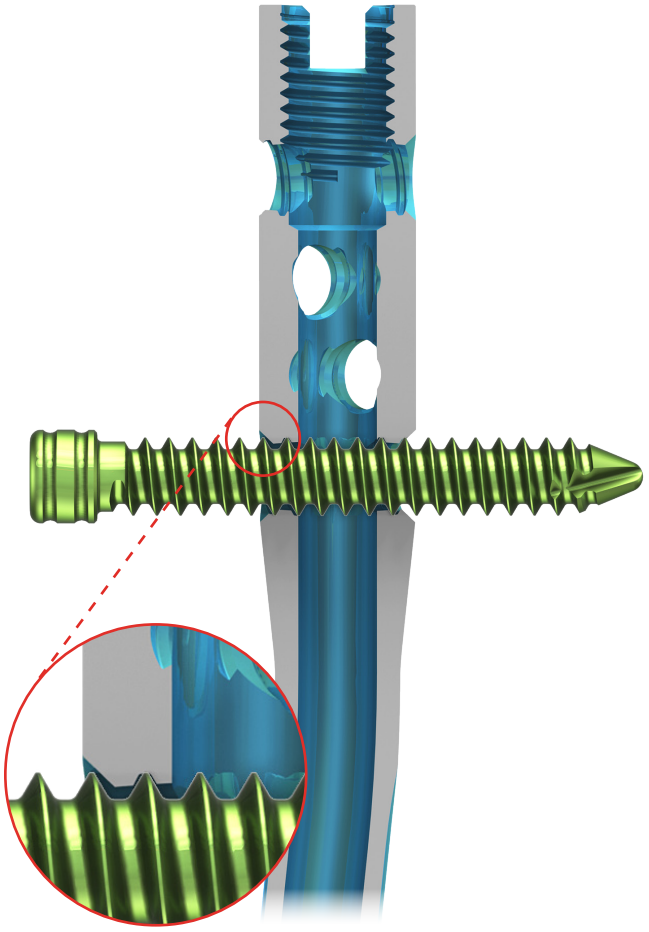
Exemplary versions of locking the reconstruction humeral nail:

Nail design enables implantation in right and left limb. Nails in short and long version can be used with the same targeter. Locking the short nails in its distal part shall be performed with use of targeter holes marked as RECONSTRUCTION, wherein the long nails shall be locked with use of slider located on the targeter *(before implantation, slider shall be placed in a way to enable set blocks freely pass the slider holes and then hit the nail holes)*, or using *"free hand"* technique. There are 4 holes in the proximal part of the reconstruction nail to reduce damaged fragments of the humerus head. Threaded locking holes in the reconstruction humeral nail allow for optional locking with use of:

- proximal locking screw 3.5 or 4.5



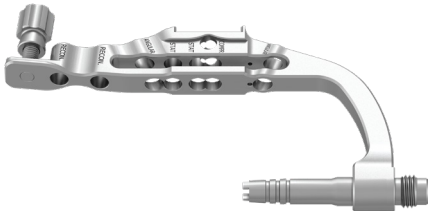
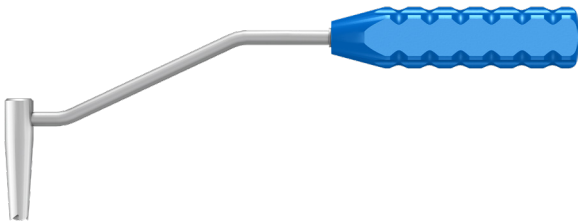
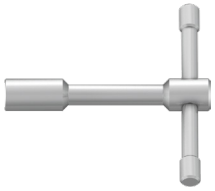
- locking screw 5.0, which by anchoring in the nail prevents angle displacement and movement of the fractured bone fragments *(using threaded hole in the nail)*.



III. INSTRUMENT SET

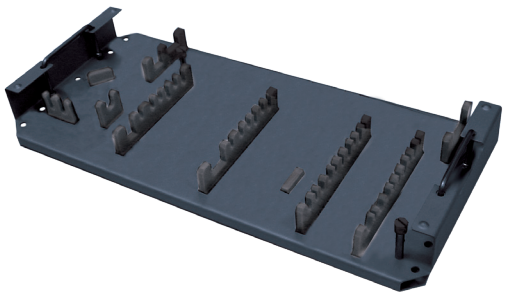
INSTRUMENT SET FOR HUMERAL NAILS **40.5020.500**

CHARFIX system

40.5020.500	Name	Catalogue No.	Pcs
	Humeral targeter B	40.5030.100	1
	Targeter D	40.5010.000	1
	Angular targeter	40.5024.000	1
	Connecting screw M7x1spec. L=101	40.5023.000	1
	Connecting screw M7x1spec. L=95	40.5023.100	1
	Set block	40.3644.000	2
	Protective guide 9/6.5	40.3645.100	2
	Drill guide 6.5/3.5	40.3646.100	2
	Drill guide 6.5/2.8	40.3661.100	2
	Drill guide 6.5/4.5	40.3697.100	1
	Trocar 6.5	40.3647.000	1
	Targeter D	40.1344.000	1
	Trocar short 7	40.1354.000	1
	Drill guide short 7/3.5	40.1358.000	1
	Drill guide 7/2.8	40.3670.000	1
	Impactor-extractor	40.3665.000	1
	Mallet	40.3667.000	1
	Connector M7/M16	40.4751.000	1
	Screwdriver S 3.5	40.5031.000	1
	Socket wrench S11	40.3648.000	1
	Screw length measure	40.3698.100	1

INSTRUMENT SET FOR HUMERAL NAILS **40.5020.500**

CHARFIX system

40.5020.500	Name	Catalogue No.	Pcs
	Guide rod 1.8/500	40.5025.000	1
	Guide rod handle	40.1351.000	1
	Teflon pipe guide 7/290	40.3699.000	1
	Drill with scale 2.8/240	40.5332.001	2
	Drill with scale 3.5/240	40.5331.001	2
	Drill with scale 4.5/240	40.5336.001	1
	Nail length measure	40.4799.000	1
	Aiming insert 9.0	40.5065.009	4
	Curved awl 8.0	40.5523.000	1
	Perforated aluminum cover 1/1 595x275x15mm gray	12.0750.200	1
	Stand	40.4492.500	1
	Container with solid bottom 1/1 595x275x86mm	12.0750.100	1

ChM sp. z o.o., Lewickie 3b, 16-061 Juchnowiec Kościelny, POLAND, tel. + 48 85 86 86 100, fax + 48 85 86 86 101, chm@chm.eu, www.chm.eu

IV. SURGICAL TECHNIQUE

IV.1. INTRODUCTION

X-Ray image of humeral fracture in AP and lateral position shall be taken before starting the operation in order to define the fracture type and the nail size *(length, diameter)*. Sometimes X-Ray image of opposite healthy humerus shall be taken. The operation shall be performed on the operating table equipped with traction and image intensifier with patient placed supine or on the healthy side *(depends on surgeon)*, on the edge of the table with radiolucent base under the arm. The intramedullary nail can be inserted into medullary canal as follows:
- proximally *(from humeral joint side)*,
- distally *(from distal part of bone shaft)*.

The surgical approach of proximal intramedullary nail insertion shall be prepared by:
- 2-3cm skin incision, starting from clavicle-shoulder joint in anterior-lateral direction, parallel to the fibers of deltoid muscle,
- splitting fibers of deltoid muscle,
- exposing supraspinous muscle attachment and its slight splitting.

IV.2. OPENING THE MEDULLARY CANAL *(PROXIMAL INSERTION OF THE HUMERAL NAIL)*

1 After preparing the surgical approach *(as described in II.1. chapter of Surgical technique)* in order to open the medullary canal, use the electric drive to insert the Kirschner wire *(Kirschner wire 2/310mm recommended)* a little bit medially, to the greater tuberculum, in the axis of medullary canal.

This step must be performed under X-Ray control.

The Kirchner wire acts as a guide for the cannulated awl.
The Kirchner wire is a single use instrument.

2 Insert the cannulated awl via the Kirschner wire to open the medullary canal for depth of approx. 7cm.

Remove the awl and Kirschner wire.

It is recommended to open medullary canal with technique described in steps 1 and 2. The surgeon can use other technique that depends on equipment of the operation suite.

40.5523.000

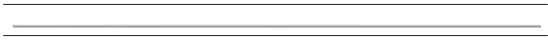
IV.3. PREPARATION OF THE MEDULLARY CANAL

Reamed canal

3 Insert the guide rod 1.8/500 **[40.5025]** into the medullary canal to the appropriate depth, reducing the fracture at the same time. Gradually widen the medullary canal with flexible reamers with 0.5mm increments, until the diameter 0.5mm wider than the diameter of the humeral nail, for the depth not lesser than the nail length, is reached.

The proximal part of the medullary canal should be reamed to the diameter of 11mm, to the depth of approx. 7cm. *(proximal part of the nail is wider than its distal part)*.

Remove the flexible reamer.
Leave the guide rod 1.8/500 **[40.5025]** in place.


40.5025.000

4 Insert the nail length measure **[40.4799]** into the guide rod 1.8/500 **[40.5025]** until it reaches the bone. The end of the guide rod indicates the implant length.


40.4799.000

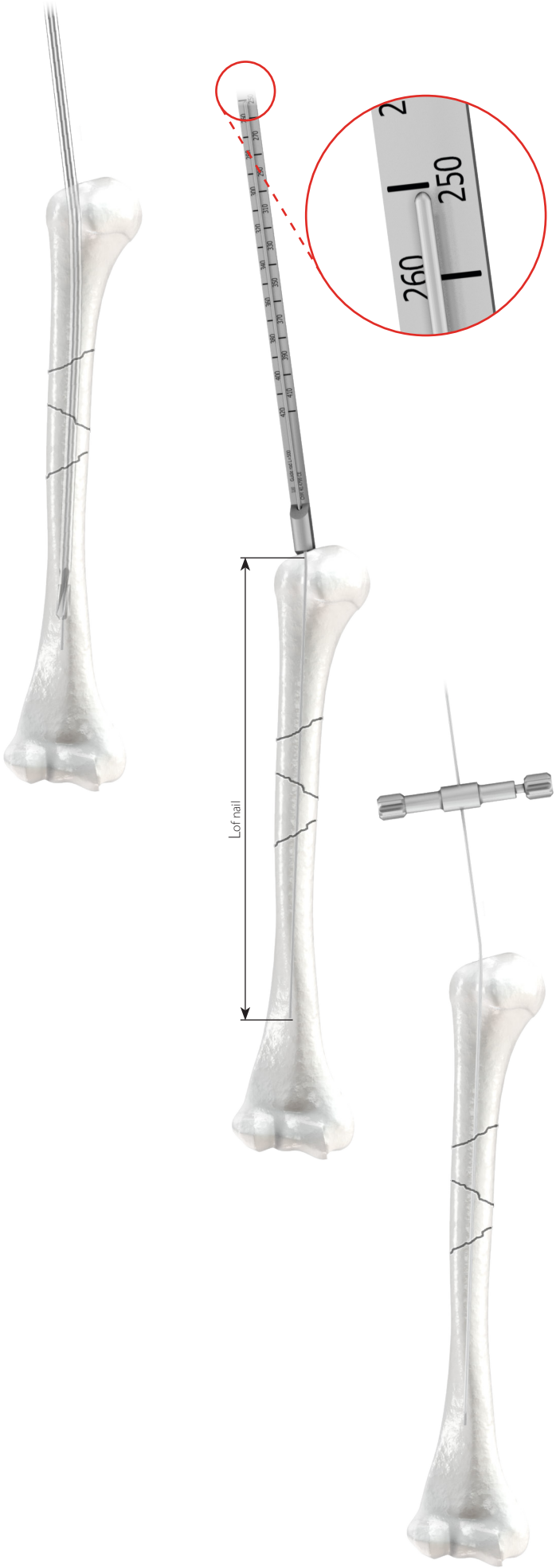
40.5025.000

5 In case of using solid nail, remove the guide rod 1.8/500 **[40.5025]** from the medullary canal using the guide rod handle **[40.1351]**.

The medullary canal is prepared for the humeral nail insertion.


40.5025.000


40.1351.000



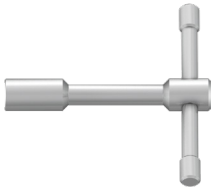
IV.4. ASSEMBLY OF THE COMPRESSION HUMERAL NAIL. POSITIONING OF THE TARGETER B. INSERTION OF THE NAIL INTO MEDULLARY CANAL

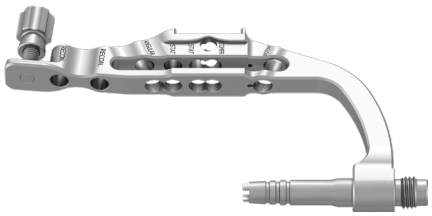
6 Using the socket wrench S11 **[40.3648]** and the connecting screw **[40.5023.000]** mount the intramedullary nail to the humeral targeter B **[40.5030.100]**. The humeral targeter B **[40.5030.100]** and the targeter D **[40.5010]** are instruments used with both compression and reconstruction humeral nails. There are several holes in its proximal part that enable nail locking.
The holes on targeter are described as follows:
- **STAT** – to enable insertion of a locking screw in the round hole in a compression nail,
- **COMPRESSION** – to enable insertion of a locking screw in the oval hole in compression nail,
- **ANGULAR** – to enable oblique insertion of a locking screw in the oval hole in compression nail,
- **RECONSTRUCTION** – to enable locking of a reconstruction nail in its distal part.

In order to eliminate failure insertion of locking screw, it is recommended to use the set blocks **[40.3644]** and to insert them in the holes in the targeter to control the mutual co-axial positioning of the holes in the targeter and in the nail. It is also recommended to mark the remaining holes with the aiming inserts **[40.5065.009]**.

Properly installed nail shall be positioned parallel to the arm of targeter B.


40.5023.000


40.3648.000


40.5030.100


40.5010.000

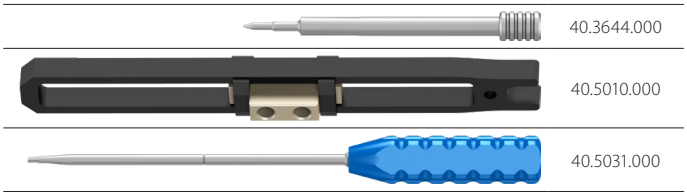

40.3644.000

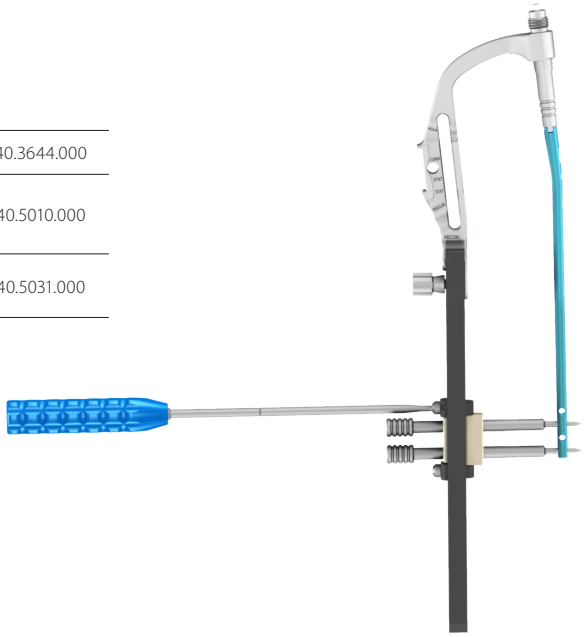

40.5065.009

7 Using two set blocks **[40.3644]** place the slider of targeter D in line with distal locking holes of intramedullary nail. Lock the slider of the targeter using the screwdriver S3.5 **[40.5031]**.

CHECK:
Properly set and secured slider enables the set blocks to smoothly hit the nail hole.

Remove the set blocks from the targeter.





8 Connect the impactor–extractor **[40.3665]** to the attached nail (install on the threaded tip of the the humeral targeter B sleeve **[40.5030.100]**).

9 Insert the humeral nail into the medullary canal to the correct depth using the mallet **[40.3667]**.

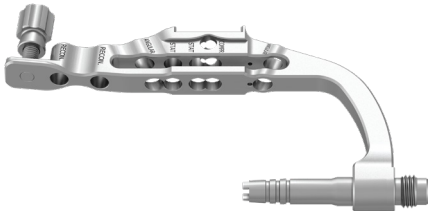
The cannulated nail shall be inserted into the humeral medullary canal via the guide rod [40.5025]. The solid nail is inserted directly into the humeral medullary canal *(without using the guide rod)*.

Dismount the impactor-extractor from the targeter.
Remove the guide rod *(if used)*.


40.3667.000

40.5025.000


40.3665.000

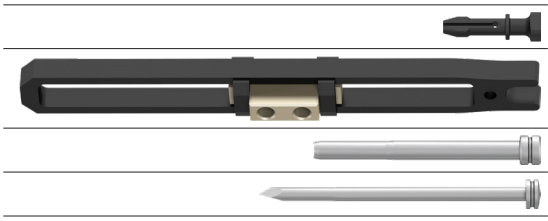

40.5030.100

IV.5. DISTAL LOCKING OF THE NAIL

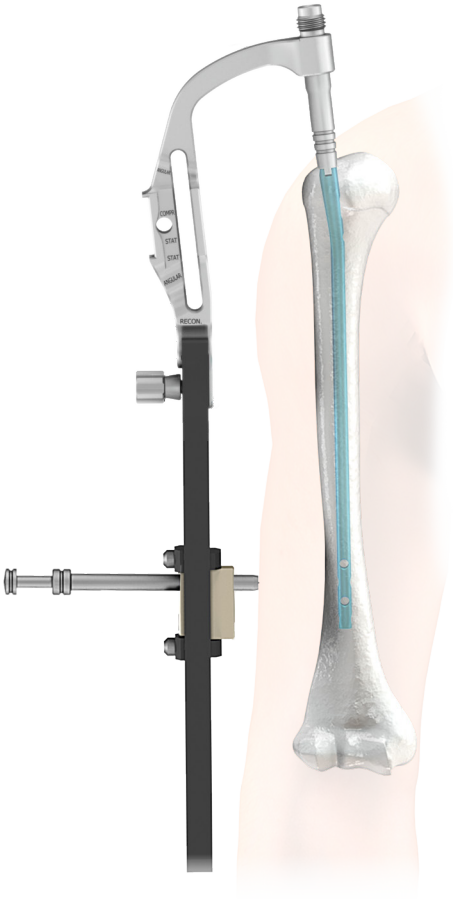
10 Before distal locking of the nail: verify with X-Ray control and the aiming inserts **[40.5065.009]** the mutual position of holes in the slider of the targeter and distal holes of the intramedullary nail.

The holes in the nail and the slider have to be in line.

Insert the protective guide **[40.3645.100]** with trocar 6.5 **[40.3647]** first into the proximal and then in the distal hole of the slider of the targeter D and mark on the skin the entry point for insertion of the locking screw. Next make 1.5cm long incision through the soft tissues.

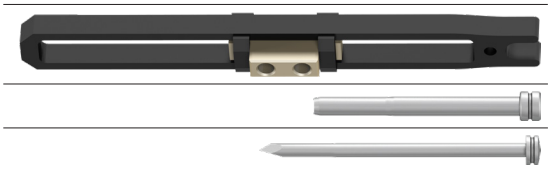


40.5065.009
40.5010.000
40.3645.100
40.3647.000

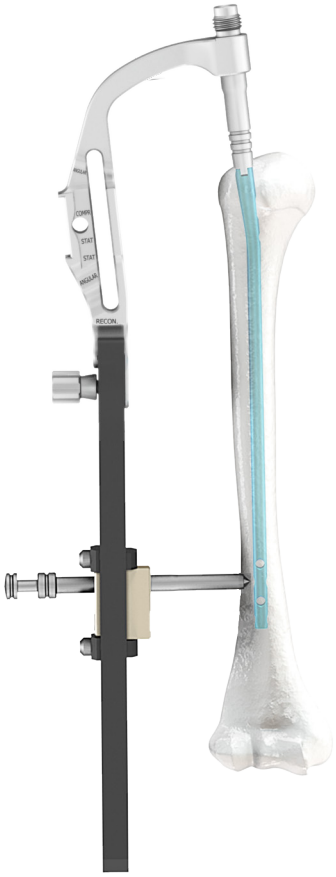


11 Insert the protective guide **[40.3645.100]** with trocar 6.5 **[40.3647]** into the hole in the slider of the targeter D and advance into prepared insicion until it reaches the cortex bone. Using the trocar, mark the entry point for the locking screw.

Remove the trocar.
Leave the protective guide in the slider hole.



40.5010.000
40.3645.100
40.3647.000



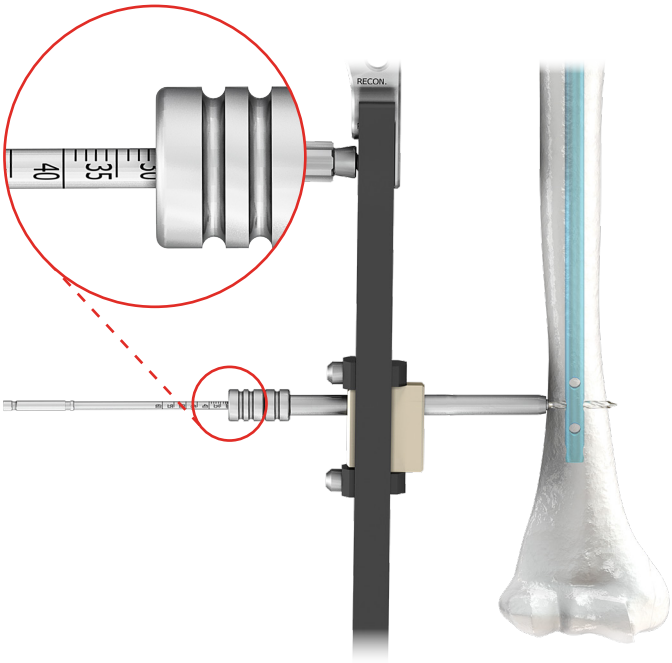
12 Drill the hole in the humeral bone for locking screw insertion.

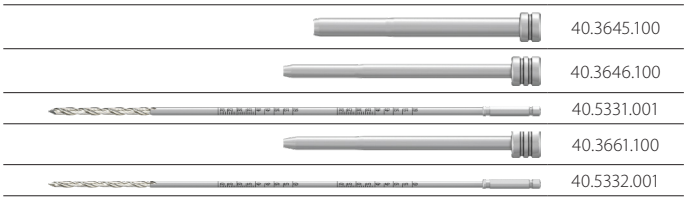
OPTION I
Implantation of 8 or 9mm nails *(with use of 4.5mm screws)*.
Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide 9.0/6.5 **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance such system through the drill guide 6.5/3.5 **[40.3646.100]**. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element.

OPTION II
Implantation of 6 or 7mm nails *(with use of 3.5mm screws)*.
Insert the drill guide 6.5/2.8 **[40.3661.100]** into the protective guide 9.0/6.5 **[40.3645.100]**. Mount the drill with scale 2.8/240 **[40.5332.001]** on the surgical drive and advance such system through the drill guide 6.5/2.8 **[40.3661.100]**. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element.

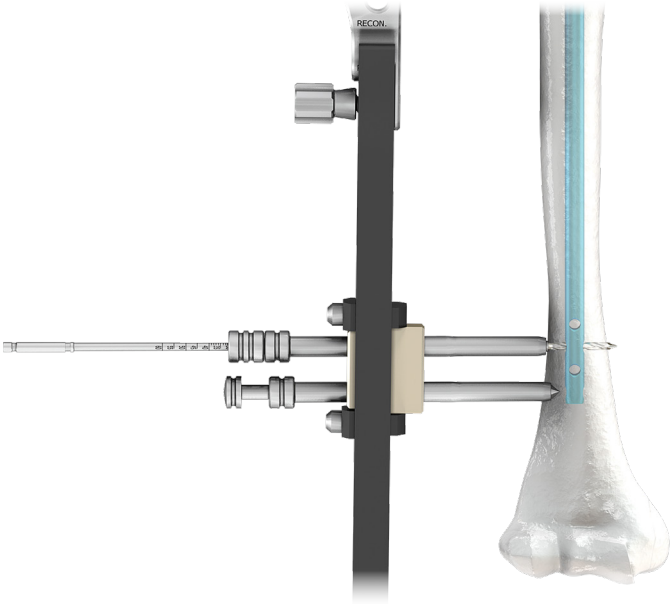
Disconnect the surgical drive and the drill.
Leave in place the following system: protective guide - drill guide - drill.

OPTION I **[40.3645.100]** - **[40.3646.100]** - **[40.5331.001]**
OPTION II **[40.3645.100]** - **[40.3661.100]** - **[40.5332.001]**



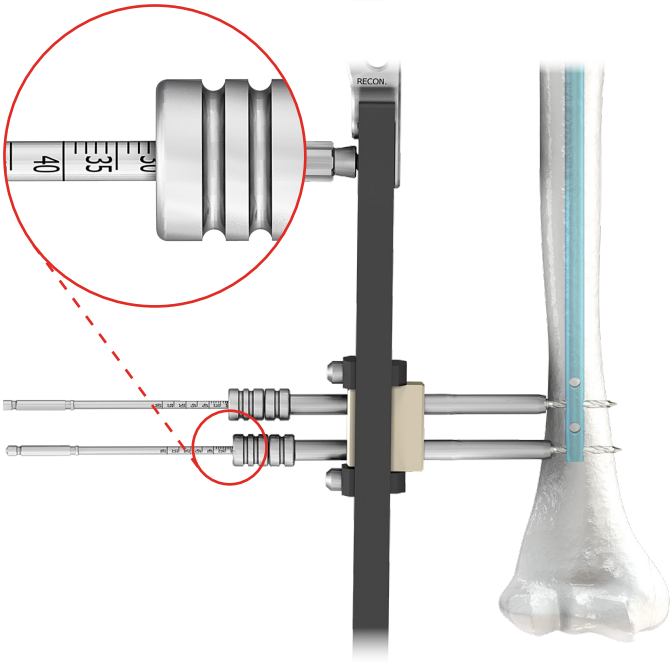


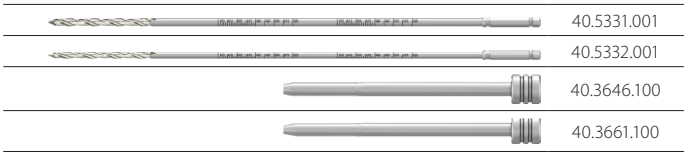
13 Mark the entry point for the other locking screw insertion. Repeat step 11.



14 Make the canal in the bone for the other locking screw insertion. Repeat step 12. Remove the drill **[40.5331.001]** or **[40.5332.001]** and the drill guide **[40.3646.100]** or **[40.3661.100]** just after reaming the canal.

Leave the protective guide in the hole of the targeter slider.

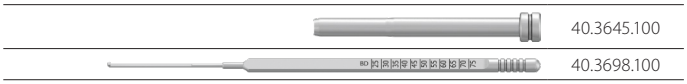


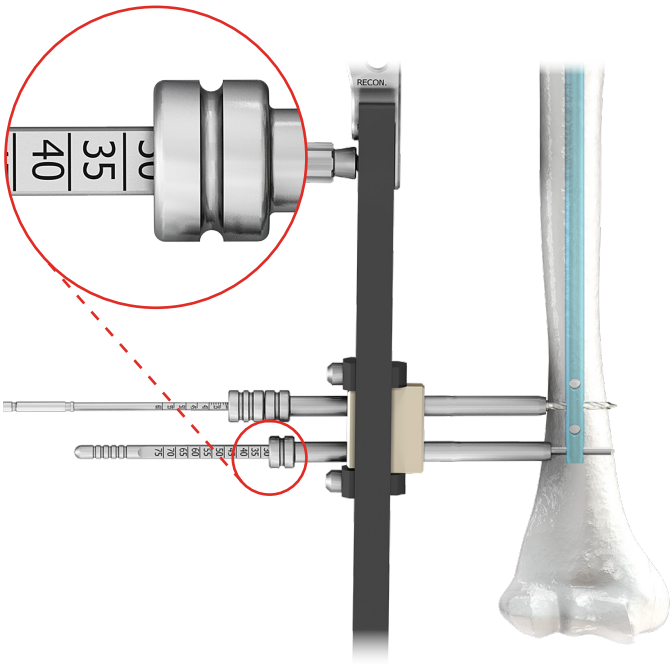


15 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** until its hook reaches the cortex on the other side of the bone. Read the length of the locking screw on the B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.

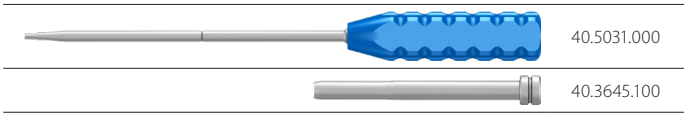
Remove the screw length measure.
Leave the protective guide in the hole of targeter slider.

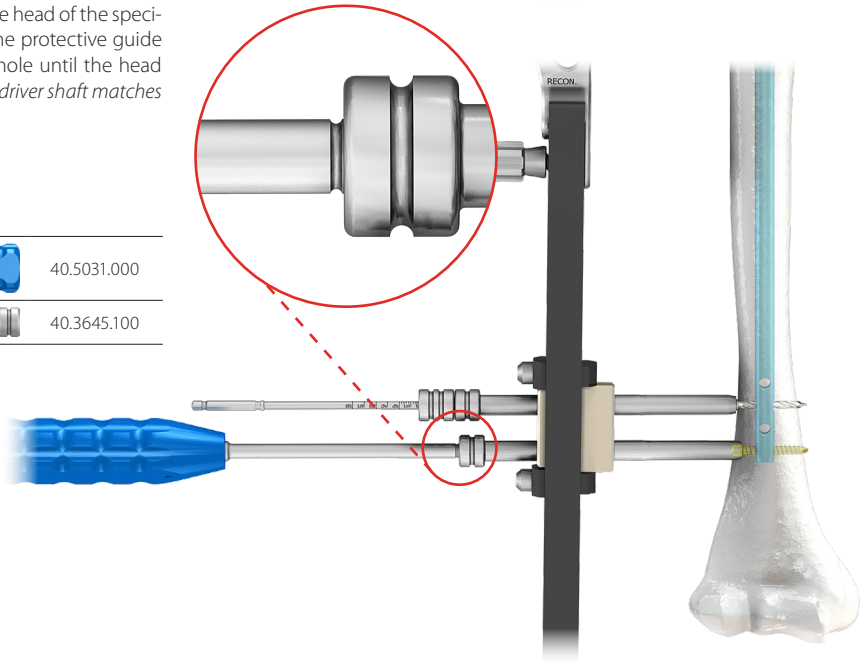




16 Insert the tip of the screwdriver S3.5 **[40.5031]** into the head of the specified locking screw. Then advance such system into the protective guide **[40.3645.100]** and insert the locking screw into prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

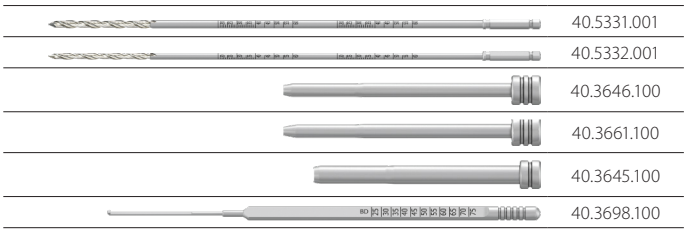
Remove the screwdriver.

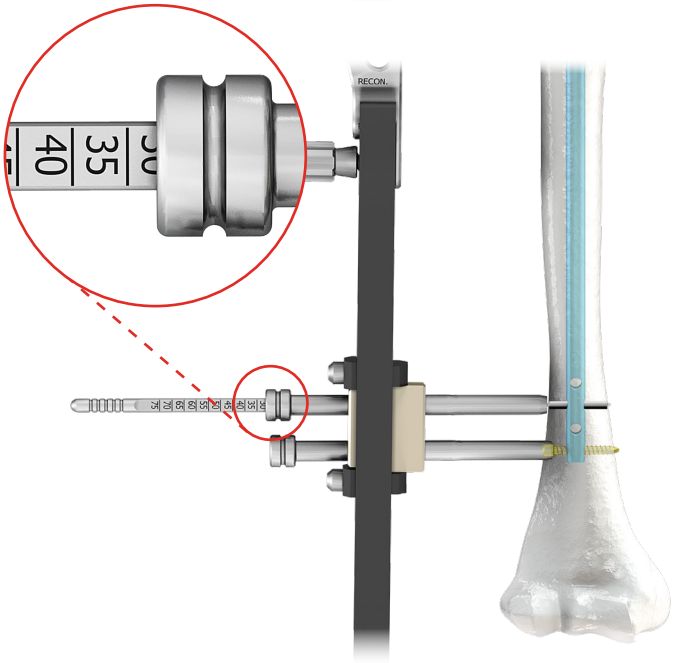




17 Remove the drill **[40.5331.001]** or **[40.5332.001]** and the drill guide **[40.3646.100]** or **[40.3661.100]** from the other hole of the slider of the targeter.
Leave the protective guide **[40.3645.100]** in the slider hole.
Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]**, until its hook reaches the cortex on the other side of the bone.
Read the length of the locking screw on the B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.



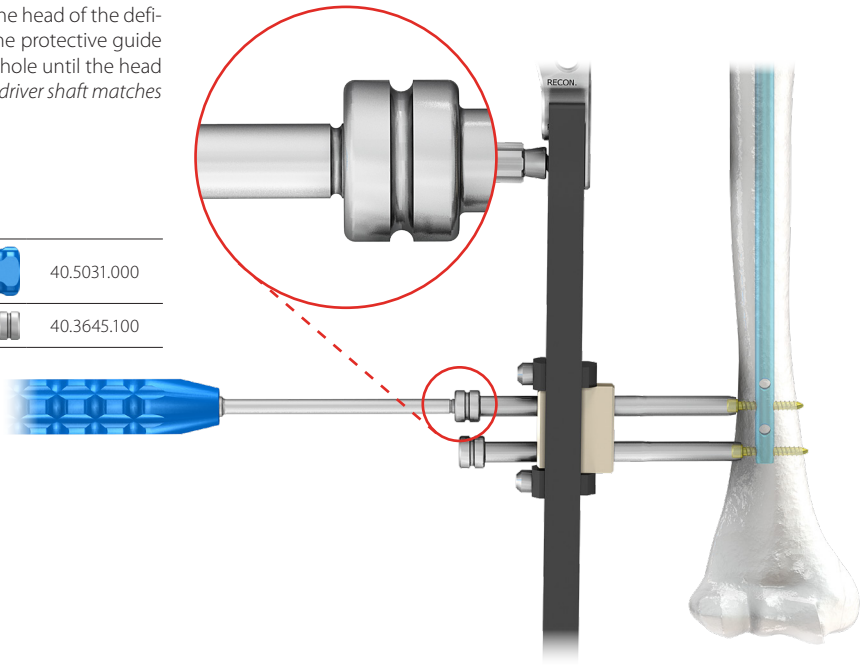


18 Insert the tip of the screwdriver S3.5 **[40.5031]** into the head of the definite locking screw. Then advance such system into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and the protective guide.


40.5031.000

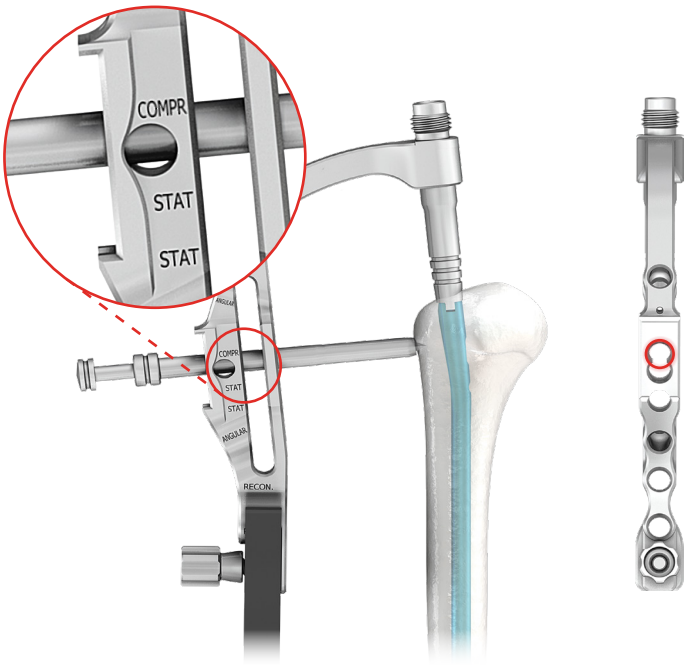

40.3645.100



IV.6. PROXIMAL LOCKING OF THE NAIL

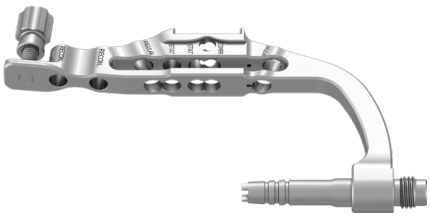
IV.6.1. Dynamic method and dynamic with compression *(compressive)* method

The hole marked as COMPRESSION on the proximal part of the targeter should be used in dynamic or compressive intramedullary fixation.



19 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the humeral targeter B hole marked as COMPRESSION. Mark on the skin the entry point for locking screw using the trocar and make adequate 1.5cm long incision through the soft tissues. Advance the protective guide with the trocar into prepared incision until the tip reaches the cortex bone. Mark the entry point for the drill.

Remove the trocar.
Leave the protective guide in place.


40.5030.100


40.3645.100


40.3647.000

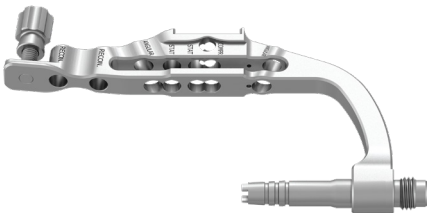
20 Insert a drill guide 3.5 **[40.3646.100]** in the protective guide **[40.3645.100]**. Using an electric drill and guiding the drill 3.5/240 **[40.5331.001]** in the drill guide, make a hole for a locking screw under the control of X-Ray.

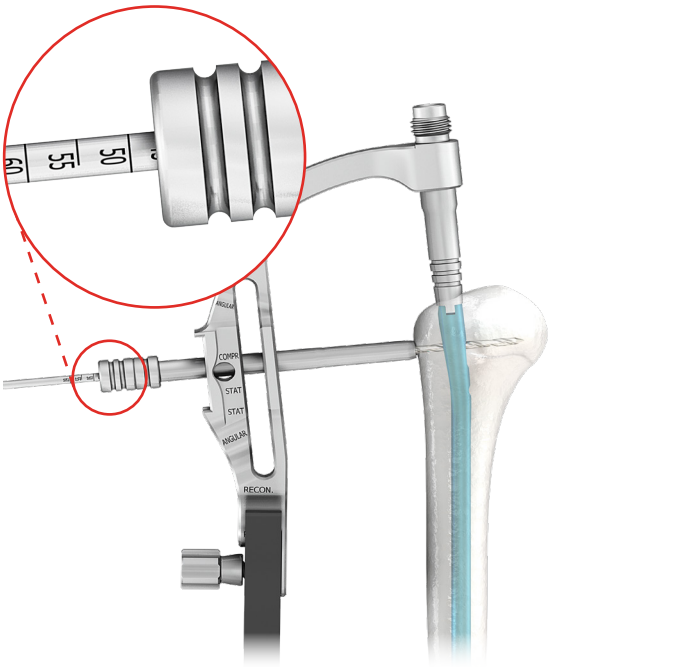
Remove the drill and the drill guide.
Leave the protective guide in the hole of the humeral targeter B **[40.5030.100]**.


40.3645.100


40.3646.100

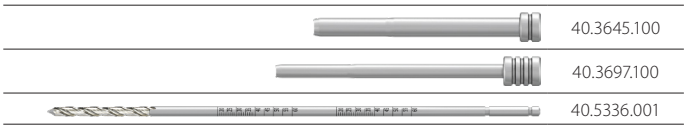
40.5331.100

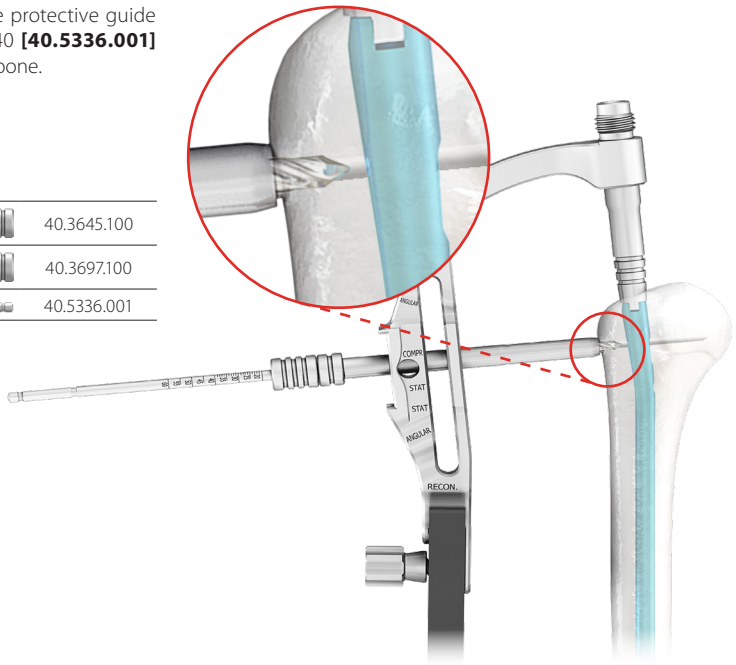

40.5030.100



20a Insert the drill guide 6.5/4.5 **[40.3697.100]** into the protective guide **[40.3645.100]**. Advance the drill with scale 4.5/240 **[40.5336.001]** through the drill guide and widen the hole in the first cortex bone.

Remove the drill and the drill guide.
Leave the protective guide in the targeter hole.

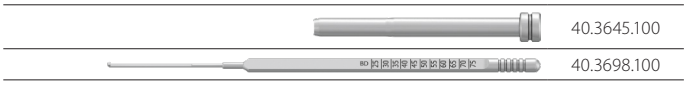


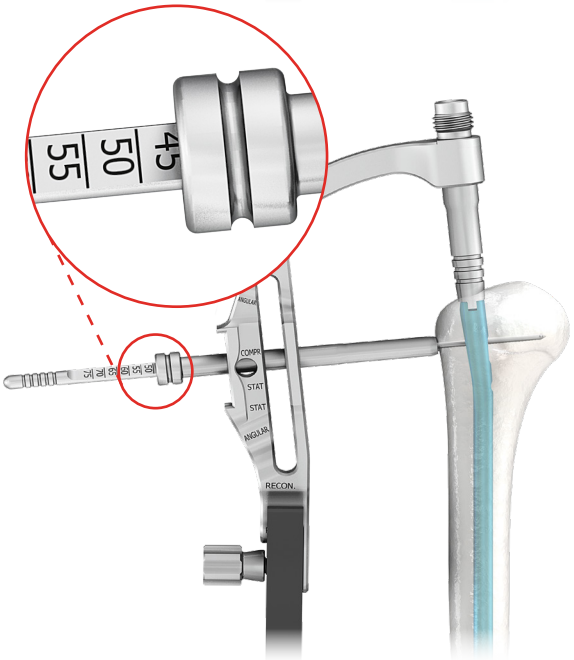


21 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on the D-B scale.

During the measurement the end of the protective guide should rest on the cortex bone.

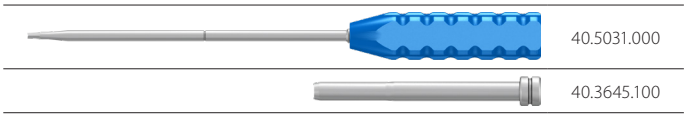
Remove the screw length measure.
Leave the protective guide in hole of the targeter.

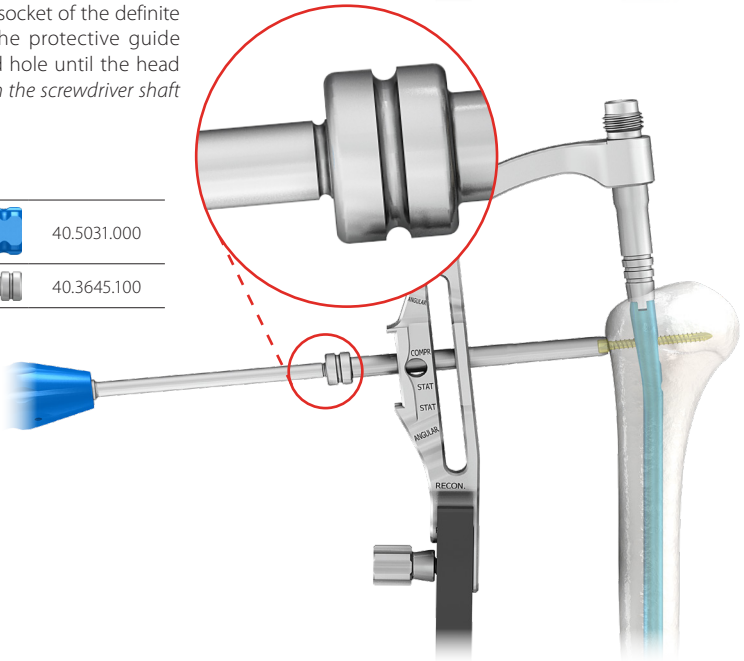




22 Insert the tip of the screwdriver **[40.5031]** into the socket of the definite locking screw. Then advance such system into the protective guide **[40.3645.100]**. Insert the locking screw into the prepared hole until the head of the screw reaches the cortex of the bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.



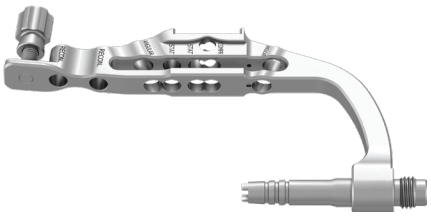


IV.6.2. STATIC METHOD

The hole marked as STAT on the proximal part of the targeter should be used in static fixation. The second hole may be used for nail locking by the second locking screw *(by proximal screw)*.

23 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the humeral target B **[40.5030.100]** hole marked as STAT. Mark on the skin the entry point for the locking screw and make an adequate incision through the soft tissues approx. 1.5cm in length. Insert the protective guide together with the trocar until its end reaches the cortex bone and mark the entry point for the drill.

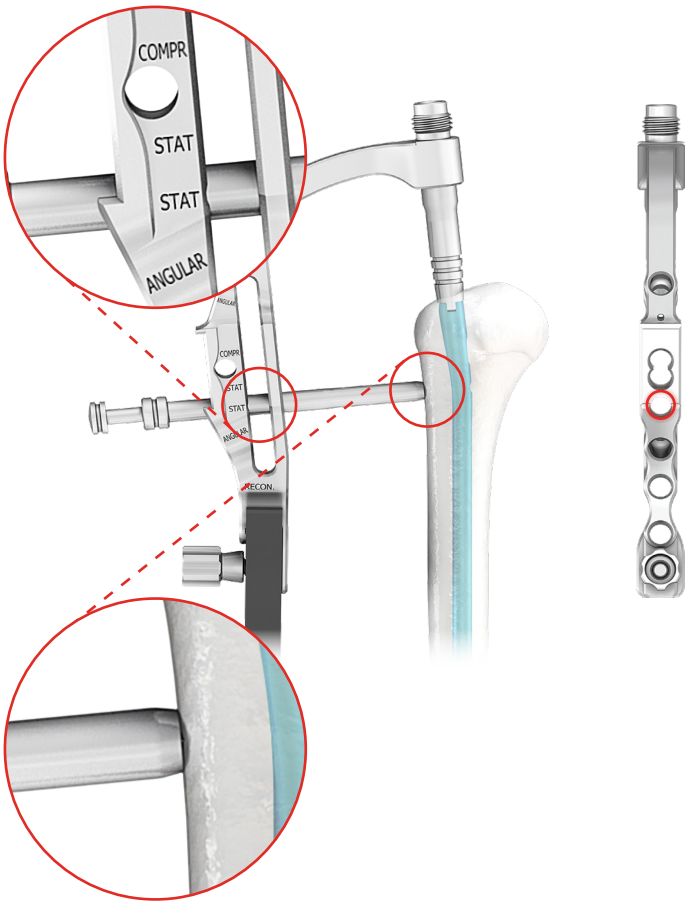
Remove the trocar.
Leave the protective guide in the targeter hole.



40.5030.100

40.3645.100

40.3647.000



24 Drill the hole in the humeral bone for locking screw insertion.

OPTION I
Implantation of 8 or 9mm nails *(with use of 4.5mm screws)*.
Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element.

OPTION II
Implantation of 6 or 7mm nails *(with use of 3.5mm screws)*.
Insert the drill guide 6.5/2.8 **[40.3661.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 2.8/240 **[40.5332.001]** on the surgical drive and advance it through the drill guide. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element.

Remove the drill and the drill guide.
Leave the protective guide.

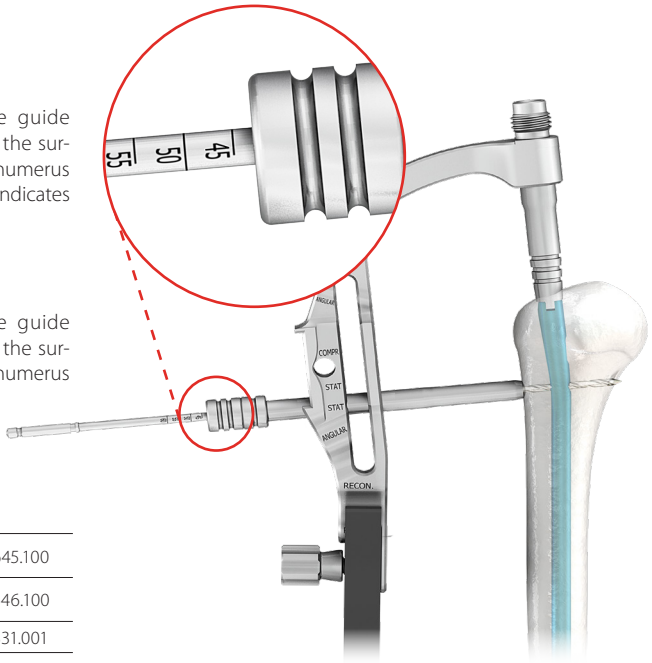
40.3645.100

40.3646.100

40.5331.001

40.3661.100

40.5332.001

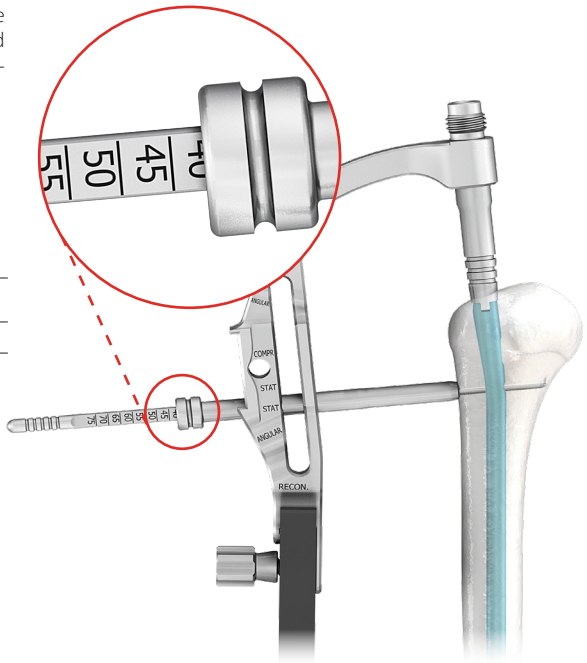


25 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on the B-D scale. During the measurement the end of the protective guide should rest on the cortex bone.

Remove the screw length measure.
Leave the protective guide in the hole of the targeter.


40.3645.100


40.3698.100



26 Insert the tip of the screwdriver **[40.5031]** into head of the specified locking screw. Then advance such system into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.

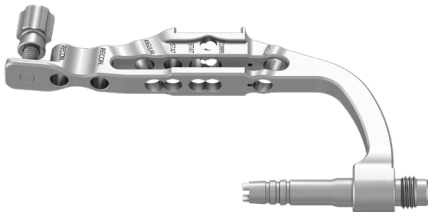

40.5031.000

40.3645.100

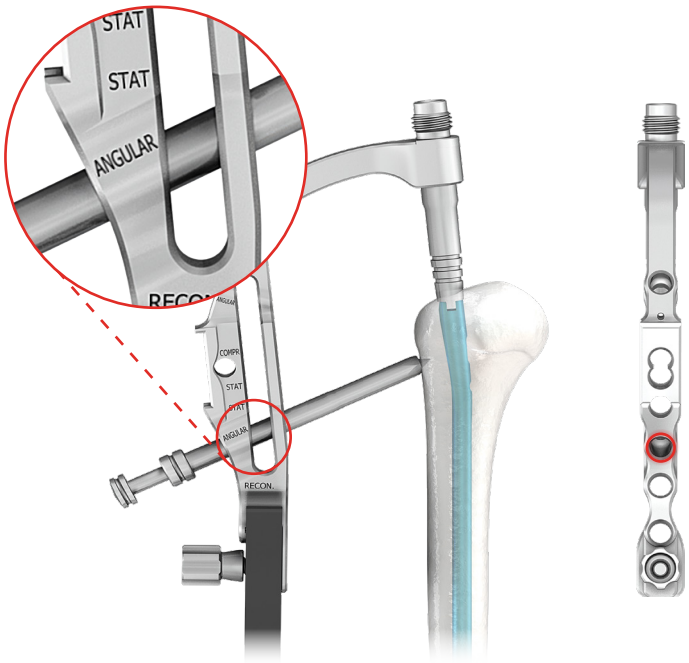

If the surgeon decides to lock the nail in the proximal part with two locking screws, insertion of the other screw should be performed as shown in steps from [20] to [22].

IV.6.3. OBLIQUE LOCKING OF THE NAIL

Design of the humeral targeter B **[40.5030.100]** enables oblique insertion of locking screw in proximal part of the nail through the holes marked **ANGULAR** and using compression screw. Before starting oblique locking of the nail, verify with the X-Ray image intensifier the mutual position of the holes in the slider of targeter and the holes in proximal part of the intramedullary nail.



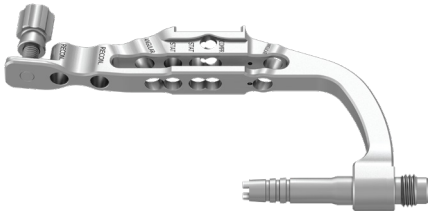
40.5030.100



The holes in the nail and the slider have to be in line.

27 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the hole marked as **ANGULAR** in the humeral targeter B **[40.5030.100]**. Mark on the skin the entry point for the locking screw and make adequate 1.5cm incision in length through soft tissues. Insert the protective guide together with the trocar so as to place its end as close to cortex as possible and mark the entry point for the drill.

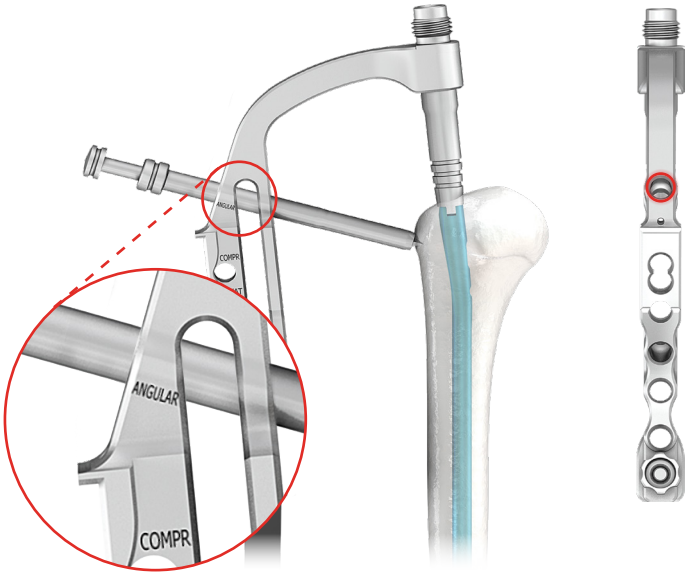
Remove the trocar.
Leave the protective guide.



40.5030.100

40.3645.100

40.3647.000



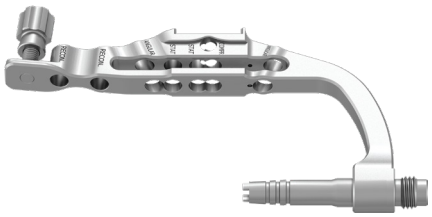
28 Insert the drill guide 3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance such system through the drill guide. Drill the hole for the locking screw in the humerus under the X-Ray control. The scale on the drill indicates the length of locking element.

Remove the drill and the drill guide.
Leave the protective guide.

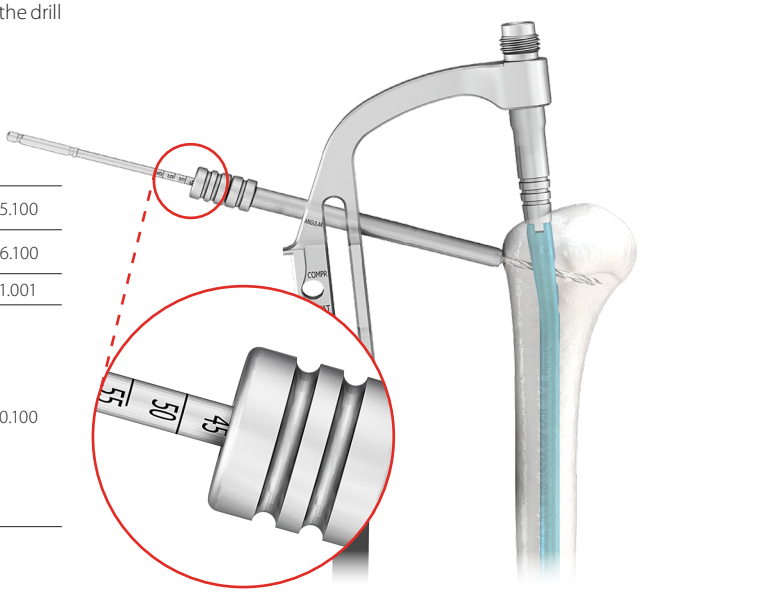
40.3645.100

40.3646.100

40.5331.001

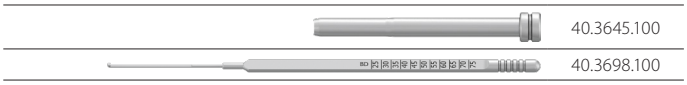


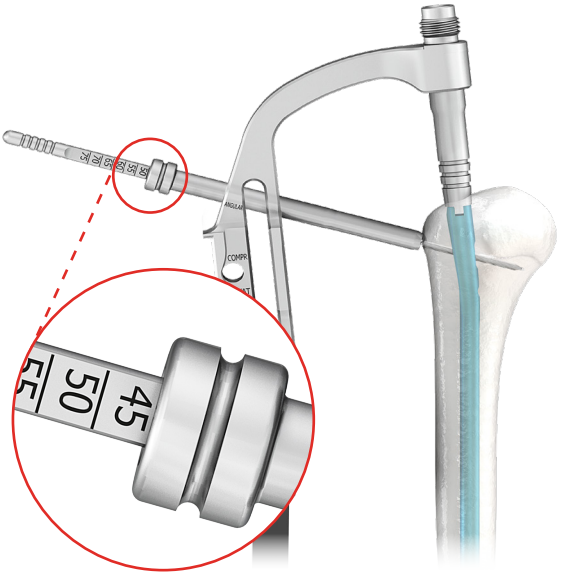
40.5030.100



29 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on B-D scale.

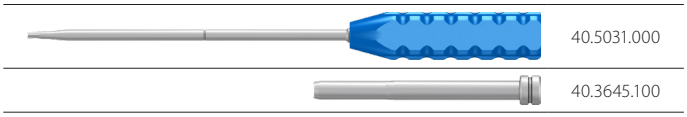
Remove the screw length measure.
Leave the protective guide.

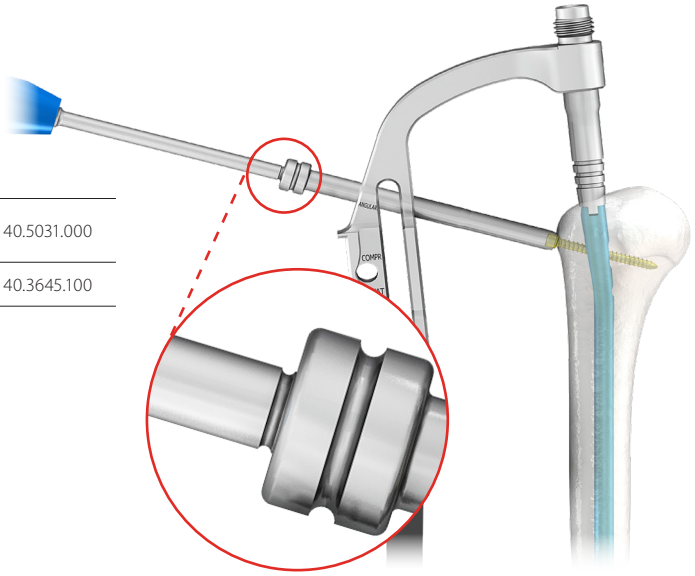




30 Insert the tip of the screwdriver **[40.5031]** into the socket of the specified locking screw **[1.1654]**. Then advance both into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.

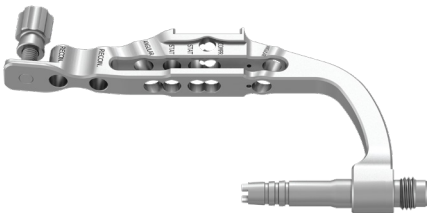




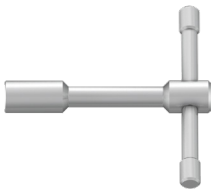
IV.7. TARGETER REMOVAL

Compression screw or end cap insertion.

31 Dismount the humeral targeter B **[40.5030.100]** from the nail using socket wrench S11 **[40.3648]** by unscrewing connecting screw **[40.5023]**.

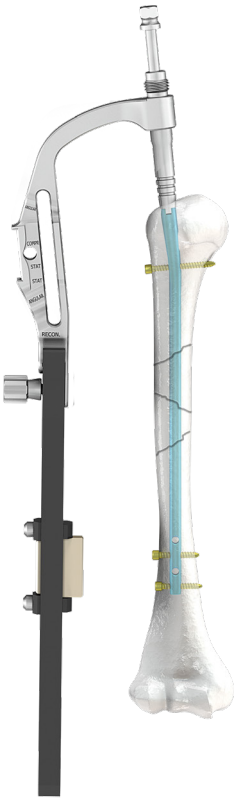


40.5030.100



40.3648.000

40.5023.000



32 Insertion of compression screw or end cap.

OPTION I

Inserting compression screw in the dynamic method with compression.

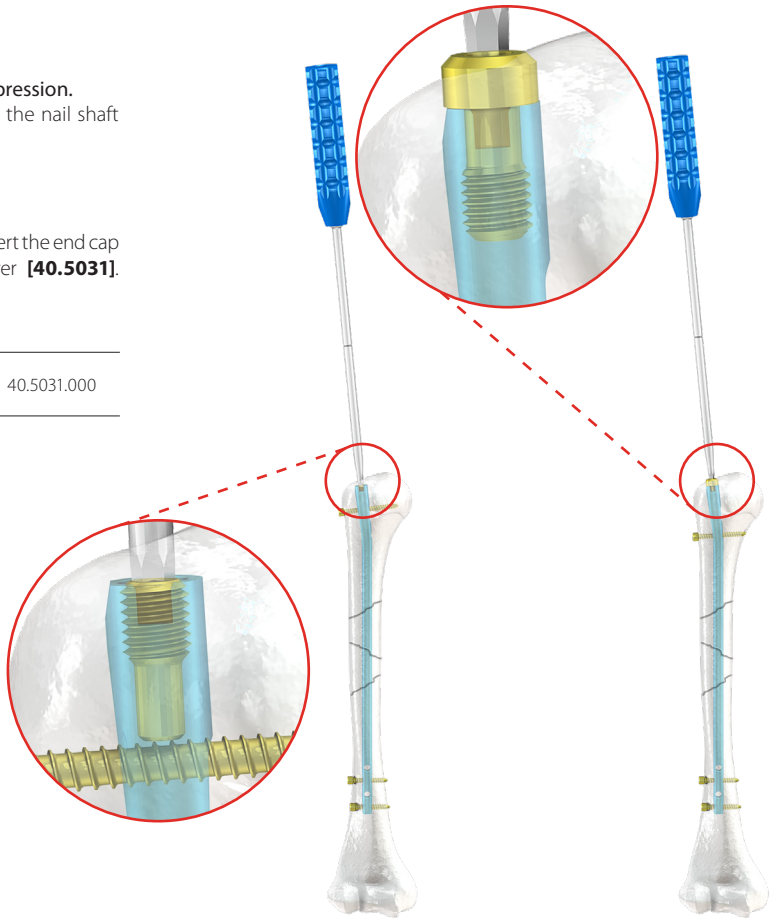
Insert the compression screw *(implant)* into the threaded hole in the nail shaft using the the screwdriver **[40.5031]**.

OPTION II

Inserting end cap in the dynamic and static method.

In order to secure the inner thread of the nail from bone ingrowth, insert the end cap *(implant)* into the threaded hole in the nail shaft using the screwdriver **[40.5031]**.

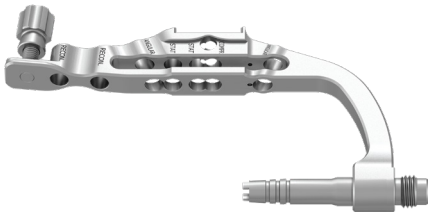
40.5031.000



OPTION I OPTION II

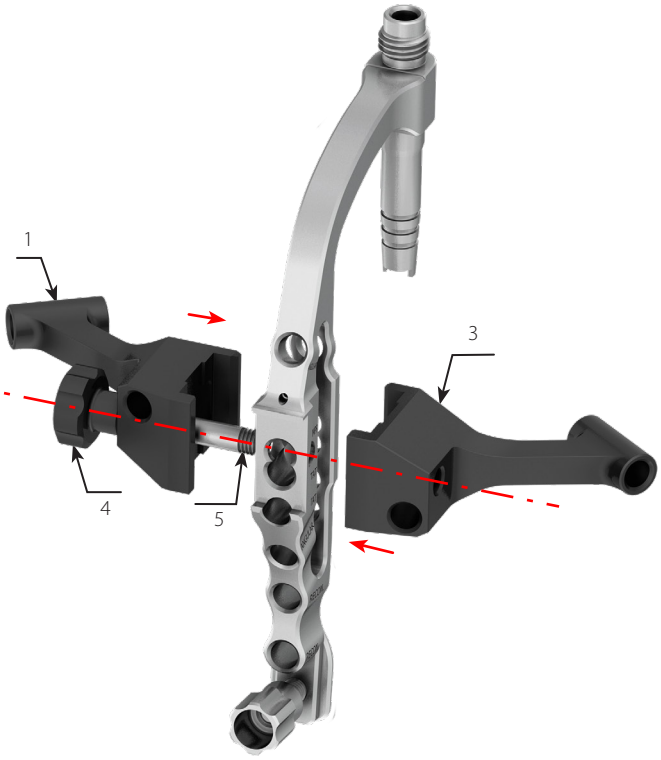
IV.8. PROXIMAL LOCKING OF A SHORT RECONSTRUCTION HUMERAL NAIL

In order to lock reconstruction humeral nail, it is necessary to mount the angular targeter **[40.5024]** to the humeral targeter B **[40.5030.100]** as showed in the picture. Insert the threaded shaft *(5)* of the angular positioner I *(1)* into lateral hole of the humeral targeter B **[40.5030.100]** then into the connective hole of angular positioner II *(3)*. Connect parts by tightening up the nut *(4)*.



40.5030.100

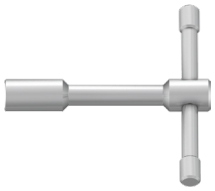
40.5024.000



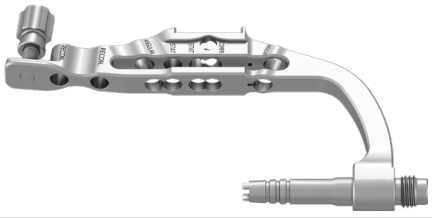
33 Using the socket wrench S11 **[40.3648]** and the connecting screw **[40.5023.100]** connect the intramedullary nail with the humeral targeter B **[40.5030.100]**.

Properly installed nail shall be positioned parallel to the arm of the humeral targeter B.

40.5023.100



40.3648.000



40.5030.100

34 Connect the impactor-extractor **[40.3665]** to the nail installed in the targeter **[40.5030.100]**.

Use mallet **[40.3667]** to insert the nail into the medullary canal as intended.

Use guide rod 1.8/500 **[40.5025]** to insert the cannulated nail into the medullary canal. The solid nail is inserted directly into the medullary canal *(without the use of the rod)*.

Install the impactor-extractor to the targeter.
Remove guide rod *(if was used)*.


40.3665.000


40.3667.000

40.5025.000

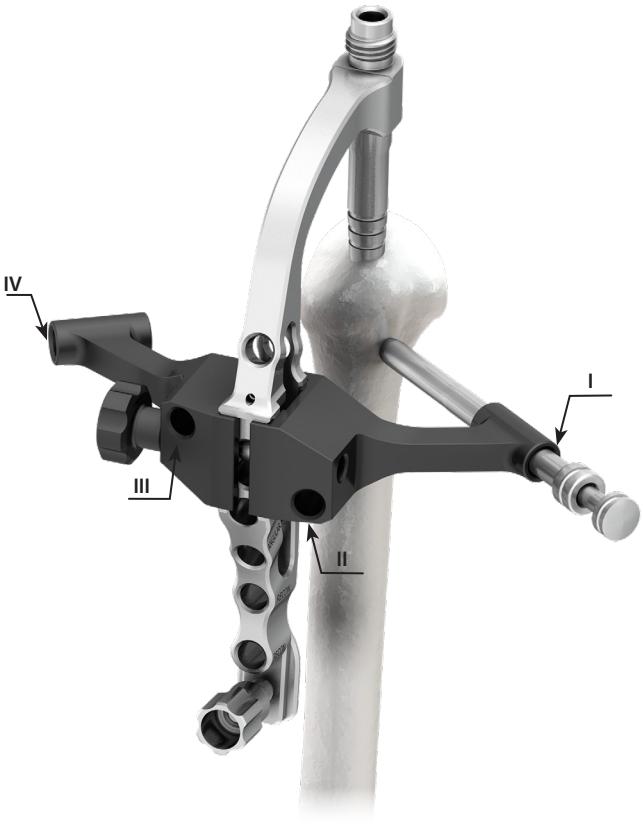
35 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into one of the holes I, II, III or IV in the angular targeter **[40.5024]**. Mark on the skin the entry point for the locking screw and make the adequate incision through the soft tissues approx. 1.5cm in length. Insert the protective guide together with the trocar until its end reaches the cortex bone and mark the entry point for the drill.

Remove the trocar.
Leave the protective guide.


40.5024.000

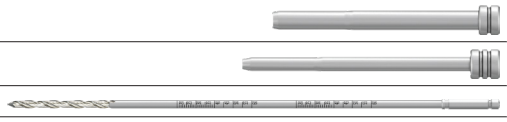

40.3645.100


40.3647.000

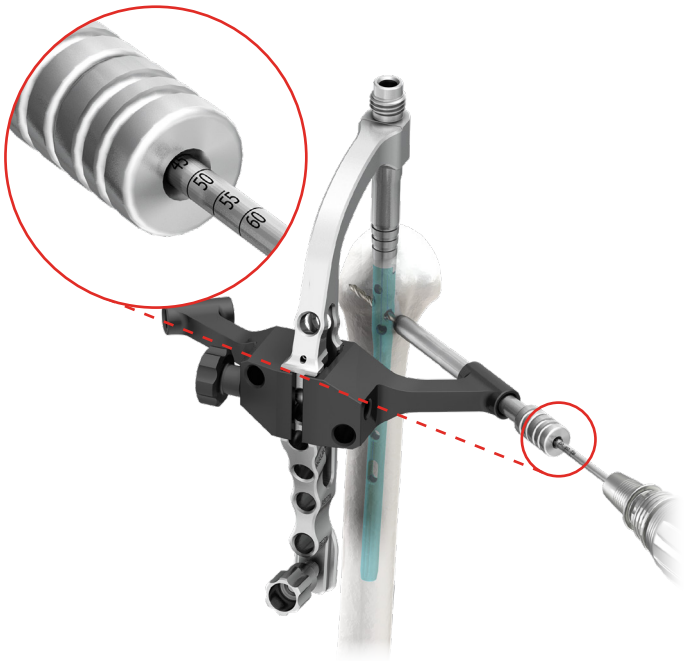


36 Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide. Drill the hole for locking screw in the humerus under the X-Ray control. Scale on the drill indicates the locking element length.

Leave the protective guide with the drill and the drill guide in the hole of the targeter.

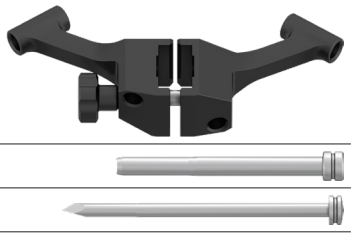


40.3645.100
40.3646.100
40.5331.001



37 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the next hole of angular targeter **[40.5024]**. Mark on the skin the entry point for the locking screw, make an adequate incision through the soft tissues approx. 1.5cm in length. Insert the protective guide together with the trocar until its end is placed as close to cortex as possible and mark the entry point for the drill using the trocar.

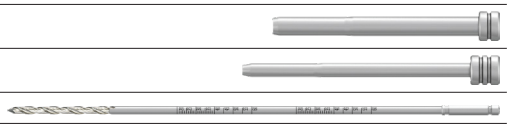
Remove the trocar.
Leave the protective guide in the hole of the targeter.



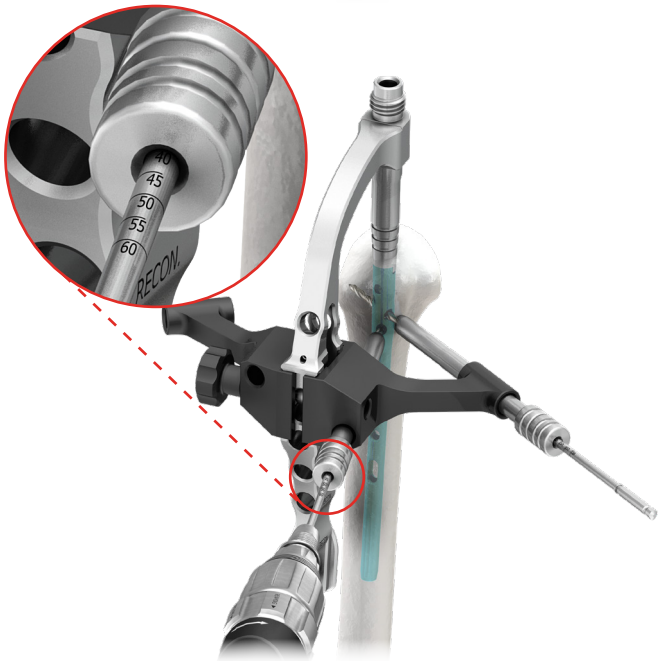
40.5024.000
40.3645.100
40.3647.000

38 Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide. Drill the hole for locking screw under the X-Ray control.

Remove the drill guide.
Leave the protective guide in the hole of the targeter.

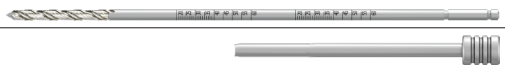


40.3645.100
40.3646.100
40.5331.001

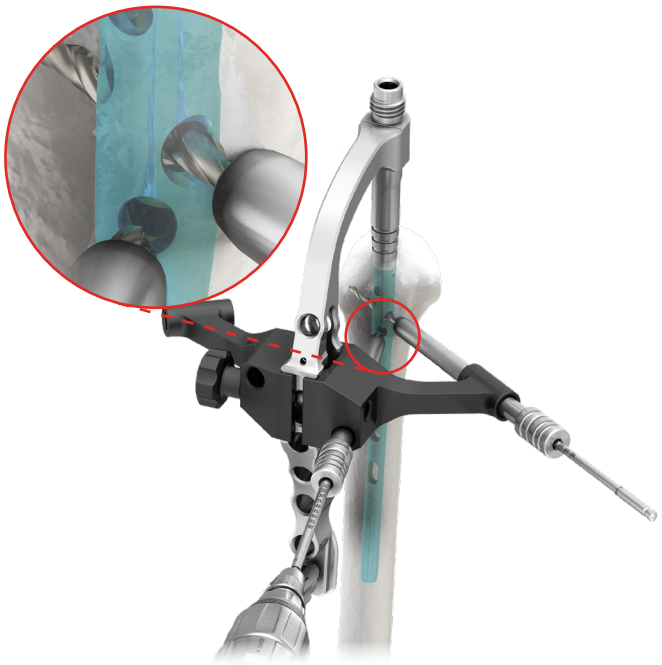


39 In case of locking with use of proximal locking screws 4.5 **[1.1653.xxx]**, ream the hole through the first cortical layer using the drill with scale 4.5/240 **[40.5336.001]** *(first, insert the drill guide 6.5/4.5* ***[40.3697.100]*** *into the protective guide 9.0/6.5* ***[40.3645.100]****)*.

Remove the drill and the drill guide.
Leave the protective guide in the hole of the targeter.

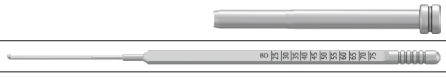


40.5336.001
40.3697.100
40.3645.100



40 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on B-D scale.

Remove the screw length measure.
Leave the protective guide in hole of the targeter.

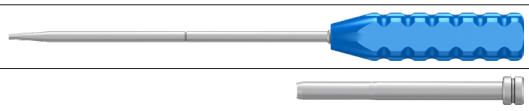


40.3645.100
40.3698.100

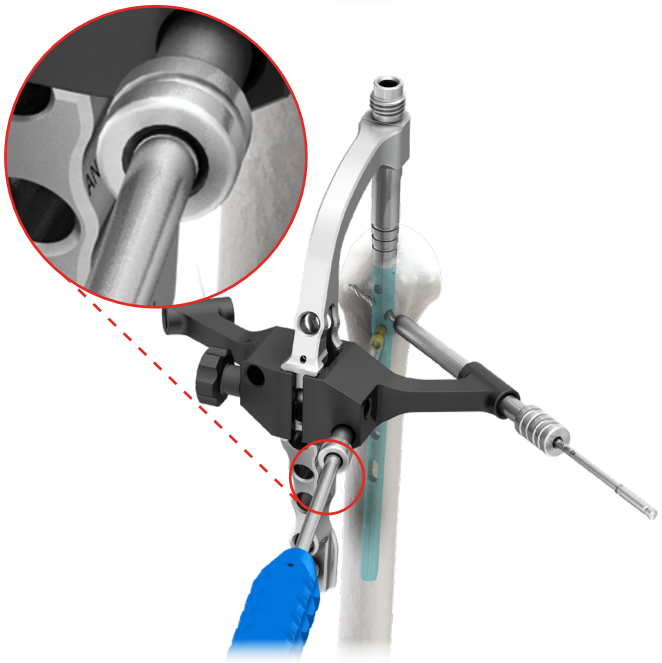
41 Insert the tip of the the screwdriver **[40.5031]** into the socket of locking screw:
- 4.5 in case of standard locking; or
- 5.0 in case of locking in threaded hole of the nail.

Then advance such system into the protective guide **[40.3645.100]** and slowly insert the locking screw into the prepared hole *(until the groove of the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver.
Leave protective guide.



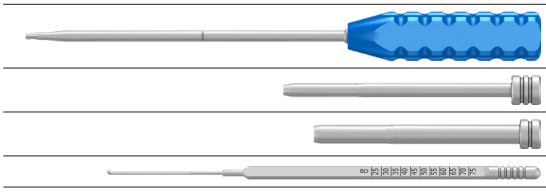
40.5031.000
40.3645.100



42 Remove the drill with scale 3.5/240 **[40.5331.001]** and the drill guide 6.5/3.5 **[40.3646.100]** from the proximal hole of the targeter. Leave in hole the protective guide **[40.3645.100]**. Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.

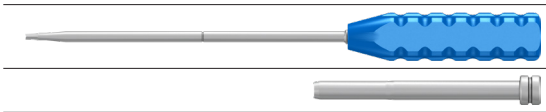
Remove the screw length measure.
Leave the protective guide in hole of the targeter.

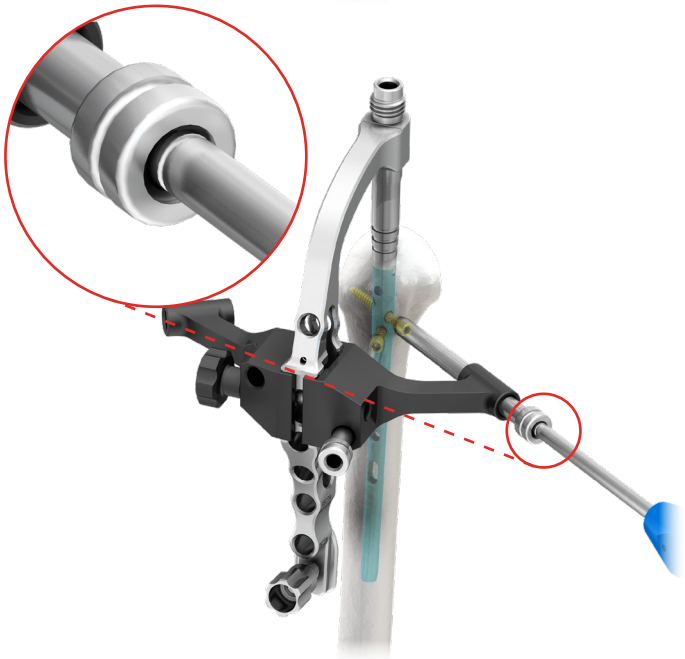


43 Insert the tip of the screwdriver **[40.5031]** into the socket of locking screw:
- 4.5 in case of standard locking; or
- 5.0 in case of locking in threaded hole of the nail.

Then advance both into the protective guide **[40.3645.100]** and carefully insert the locking screw into the prepared hole *(until the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.

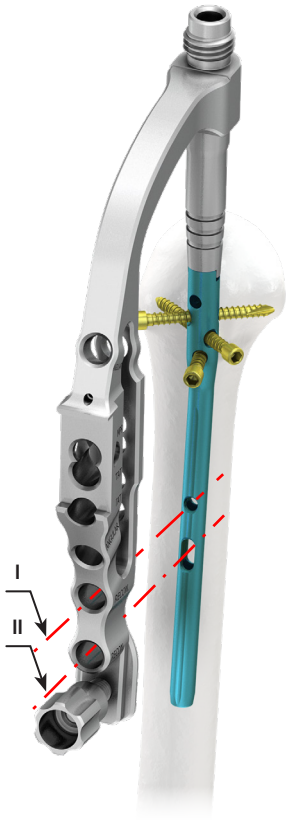




44 In order to enable locking the nail in another proximal holes, it is recommended *(after drilling the first hole and checking the correctness of the process)* to leave the drill in the hole and start locking the rest of holes or to lock the nail and to leave the protective guide on the head of locking screw in order to improve the stability of the system: nail – targeter.

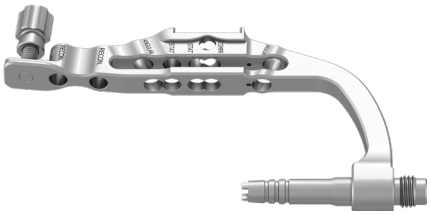
Repeat steps 37-41 in order to lock the nail using other holes.

IV.9. DISTAL LOCKING OF A SHORT RECONSTRUCTION HUMERAL NAIL



45 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the hole of the humeral targeter B marked as RECONSTRUCTION **[40.5030.100]**. Mark on the skin the entry point for locking screw and make an adequate incision through soft tissues 1.5cm in length. Advance the protective guide together with the trocar so as to put its end as close to cortex as possible and mark the entry point for the drill.

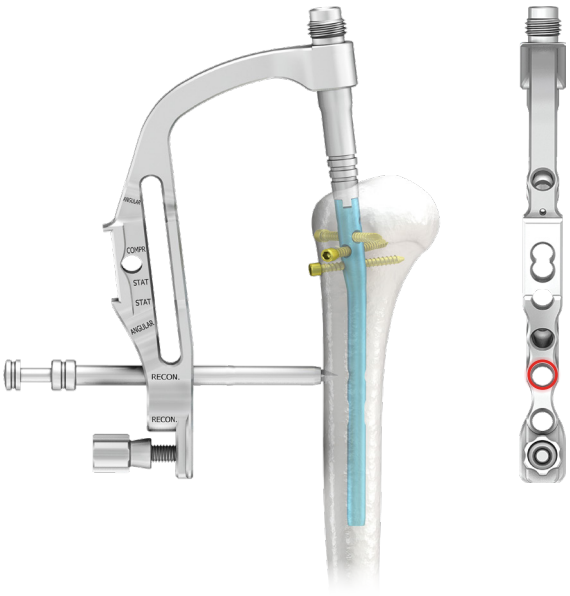
Remove the trocar.
Leave the protective guide in the hole of the targeter.



40.5030.100

40.3645.100

40.3647.000

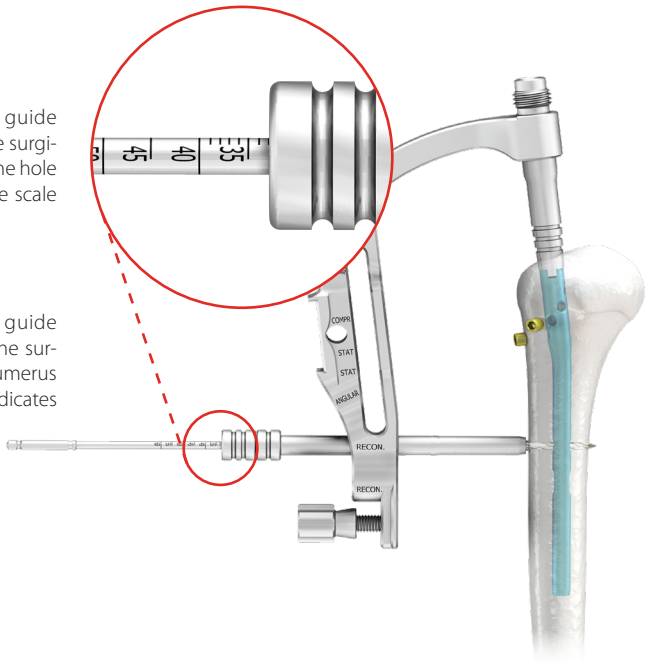


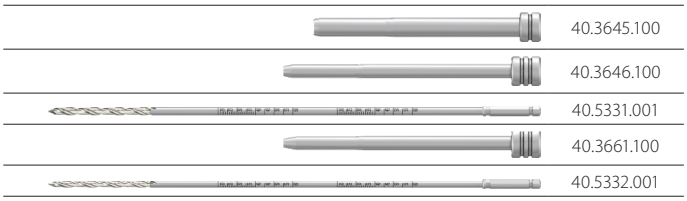
46 Drill the hole in bone for locking screw insertion.

OPTION I
Implantation of 8 or 9mm nails *(for locking use 4.5mm screws)*.
Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide **[40.3646.100]** and drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates the length of locking element.

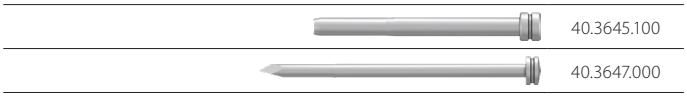
OPTION II
Implantation of 6 or 7mm nails *(for locking use 3.5mm screws)*.
Insert the drill guide 6.5/2.8 **[40.3661.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 2.8/240 **[40.5332.001]** on the surgical drive and advance it through the drill guide. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates the length of locking element.
After disconnecting the surgical drive and drill, leave in place system: protective guide – drill guide – drill.

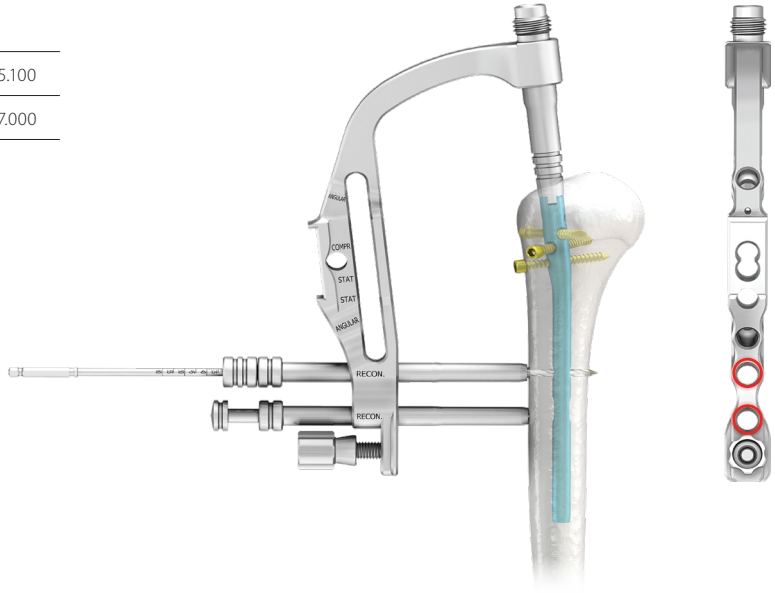
OPTION I **[40.3645.100]** - **[40.3646.100]** - **[40.5331.001]**
OPTION II **[40.3645.100]** - **[40.3661.100]** - **[40.5332.001]**





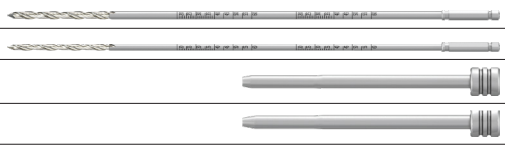
47 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the second hole marked as RECONSTRUCTION. Mark the entry point for the second locking screw. Repeat step 45.

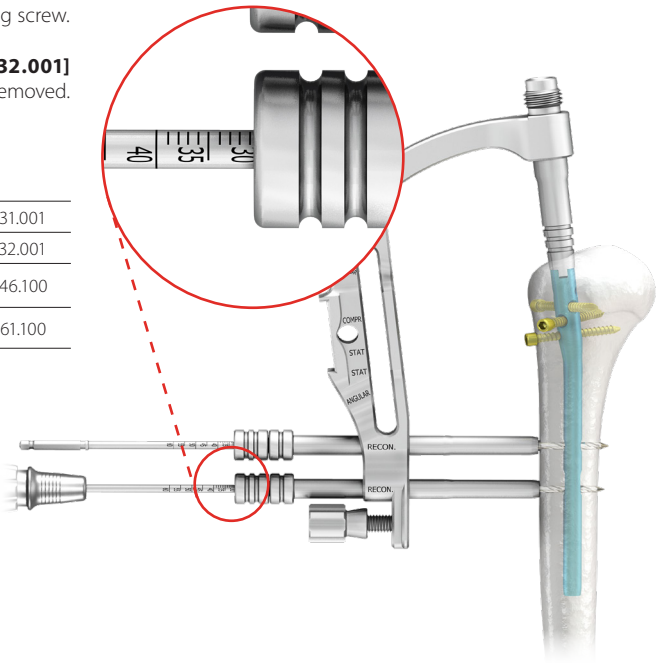




48 Drill the hole in the humerus for insertion of the second locking screw. Repeat step 46.
Directly after making the hole, the drill **[40.5331.001]** or **[40.5332.001]** and the drill guide 6.5/3.5 **[40.3646.100]** or **[40.3661.100]** should be removed.

Leave the protective guide in the hole of the targeter slider.

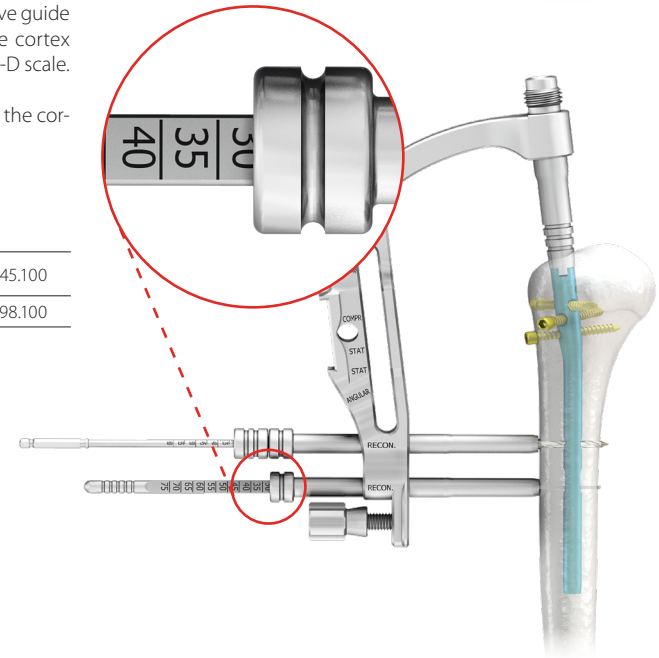




49 Insert the screw length measure **[40.3698]** through the protective guide **[40.3645.100]** into the drilled hole until its hook reaches the cortex on the other side of the bone. Read the length of the locking screw on B-D scale.

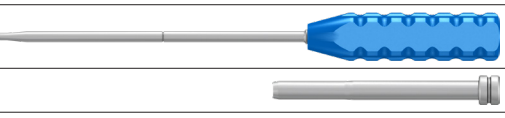
During the measurement the end of the protective guide should rest on the cortex bone.

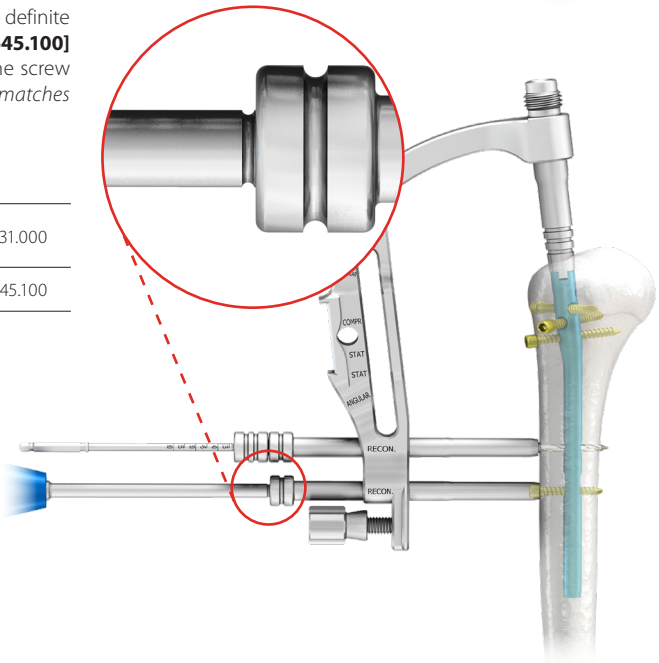
Remove the screw length measure.
Leave the protective guide in hole of targeter.



50 Insert the tip of the screwdriver **[40.5031]** into the socket of the definite locking screw. Then advance both into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole until the head of the screw reaches the cortex of the bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver.

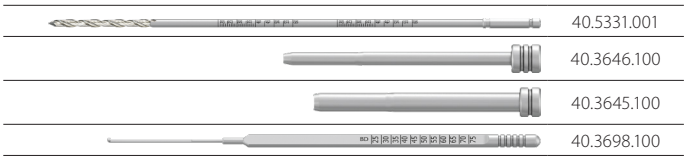


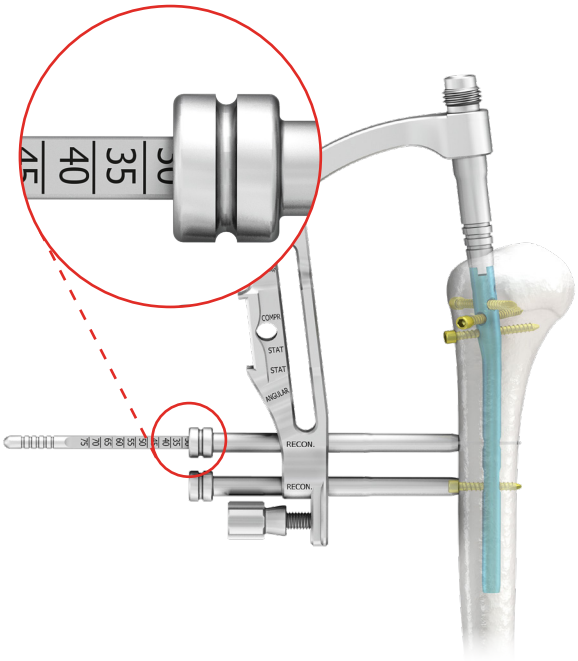


51 Remove the drill **[40.5331.001]** and the drill guide 6.5/3.5 **[40.3646.100]** from the first hole marked as **RECONSTRUCTION**. Leave the protective guide **[40.3645.100]** in the hole of the slider. Insert the screw length measure **[40.3698.100]** through the protective guide into the drilled hole until its hook reaches the cortex on the other side of the bone. Read the length of the locking screw on B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.

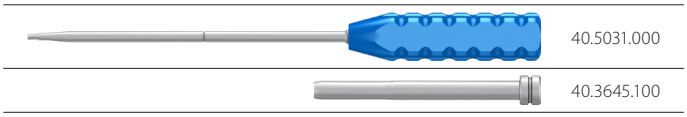
Remove the screw length measure.
Leave the protective guide in hole of targeter B.

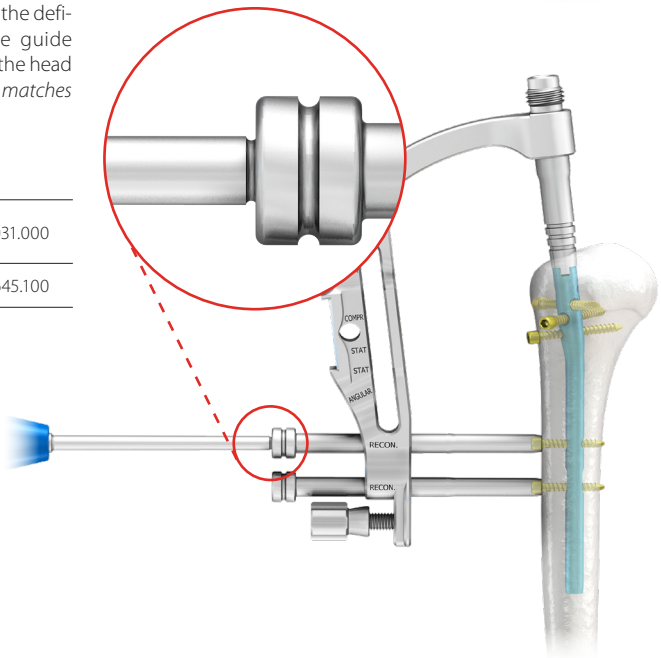




52 Insert the tip of the the screwdriver **[40.5031]** into the socket of the definite locking screw. Then advance both into the protective guide **[40.3645.100]** and insert the locking screw into the prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.



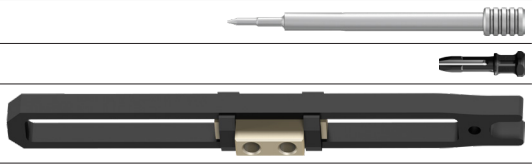


IV.10. DISTAL LOCKING OF A LONG RECONSTRUCTION HUMERAL NAIL

Use two set blocks to position the slider of the targeter in relation to the holes in the nail.
The slider should be set in accordance with step 8.

Before starting distal locking of the nail, verify using X-Ray image intensifier and aiming inserts **[40.5065.009]** the mutual position of the targeter slider holes and holes in nail distal part.

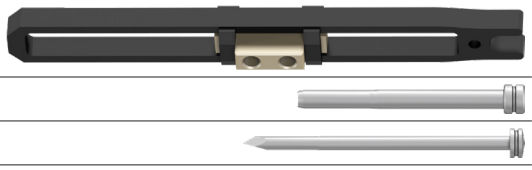
Holes of the nail and the slider have to be in line.



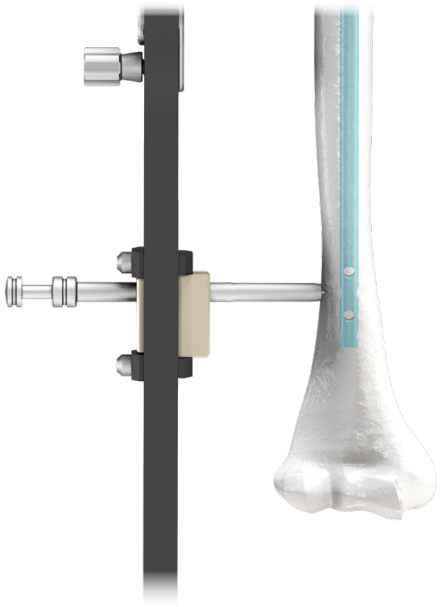
40.3644.000
40.5065.009
40.5010.000

53 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the proximal hole in the targeter slider. After marking on the skin the point for inserting the locking screw make incision through the soft tissues, approx. 1.5cm in length. Advance the protective guide with the trocar into prepared incision so as to put its end as close to cortex as possible. Using the trocar mark the point for the locking screw.

Remove the trocar.
Leave the protective guide in the hole of the slider.



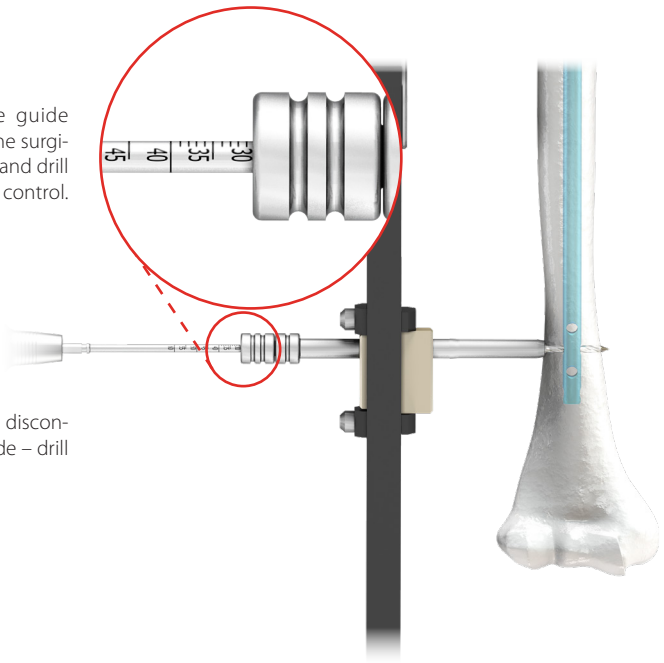
40.5010.000
40.3645.100
40.3647.000



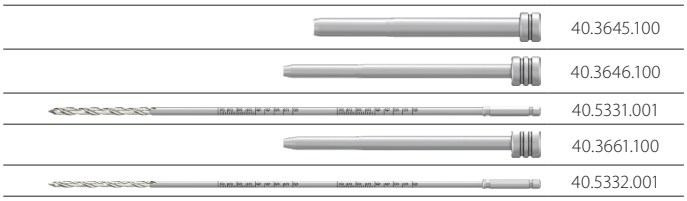
54 Drill the hole in bone for locking screw insertion.

OPTION I
Implantation of 8 or 9mm nails *(with use of 4.5mm screws)*.
Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide 6.5/3.5 **[40.3646.100]** and drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element.

OPTION II
Implantation of 6 or 7mm nails *(with use of 3.5mm screws)*.
Insert the drill guide 6.5/2.8 **[40.3661.100]** into the protective guide **[40.3645.100]**. Mount the drill with scale 2.8/240 **[40.5332.001]** on the surgical drive and advance it through the drill guide. Drill the hole in the humerus through both cortex layers under the X-Ray control. The scale on the drill indicates length of locking element. After disconnecting the surgical drive and drill, leave in place system: protective guide – drill guide – drill.

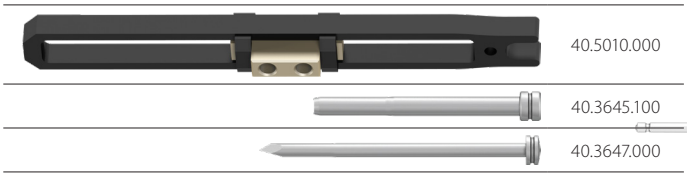


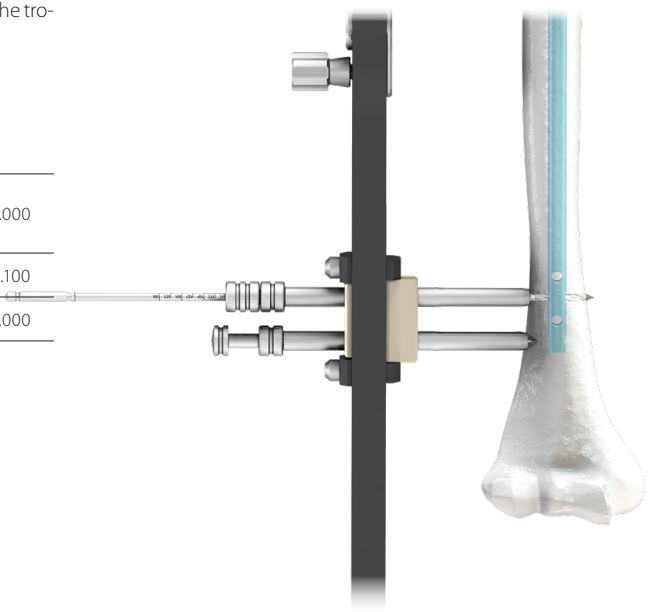
OPTION I **[40.3645.100]** - **[40.3646.100]** - **[40.5331.001]**
OPTION II **[40.3645.100]** - **[40.3661.100]** - **[40.5332.001]**



55 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the distal hole in the targeter D slider. Advance the protective guide with the trocar into prepared incision until its end reaches the cortex. Using the trocar mark the point for the locking screw.

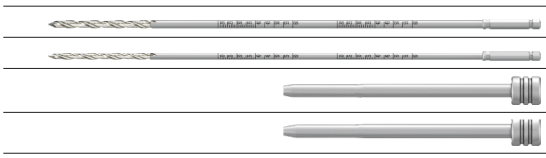
Remove the trocar.
Leave the protective guide in the hole of the slider.

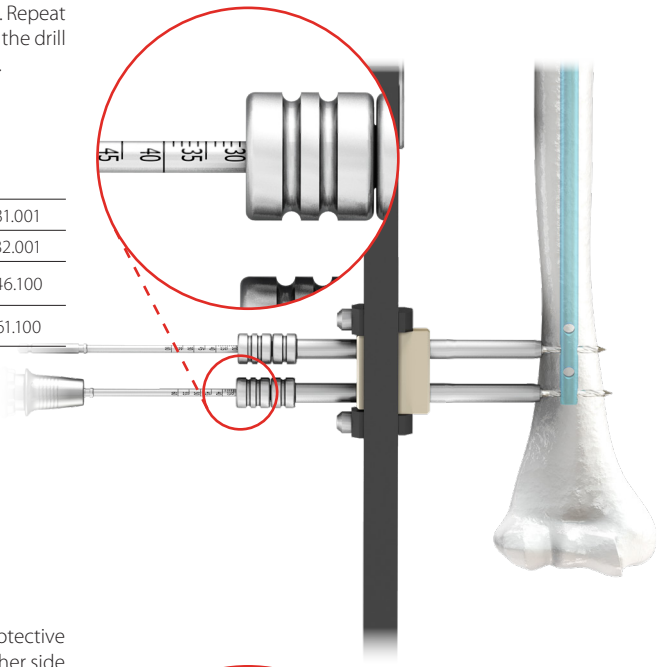




56 Make the canal in the bone for the second locking screw insertion. Repeat 12 step. Remove the drill **[40.5331.001]** or **[40.5332.001]** and the drill guide **[40.3646.100]** or **[40.3661.100]** just after reaming of the canal.

Leave the protective guide in the hole of the slider of targeter.

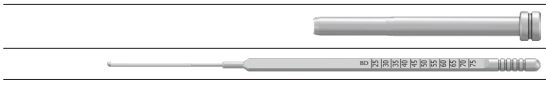


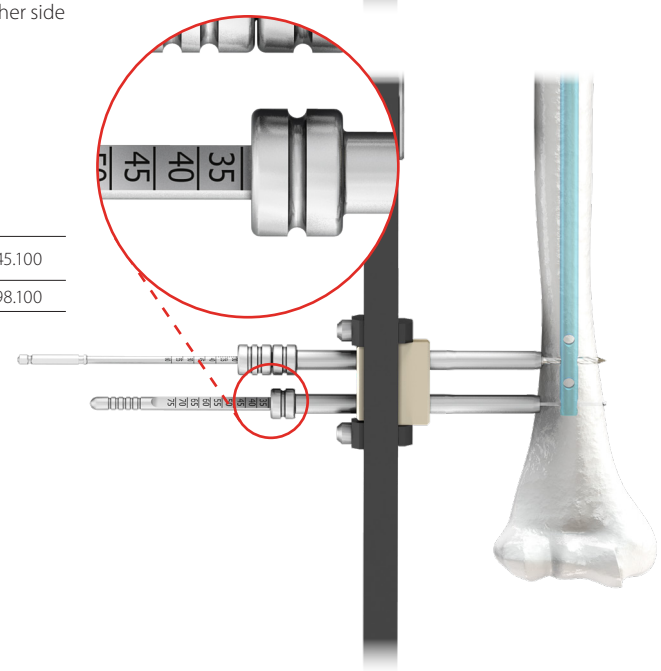


57 Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** until its hook rests on the cortex on the other side of the bone. Read the length of the locking screw on the B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.

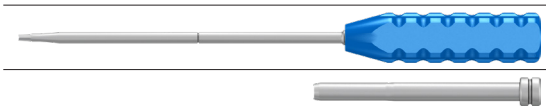
Remove the screw length measure.
Leave the protective guide in the hole of slider of targeter.

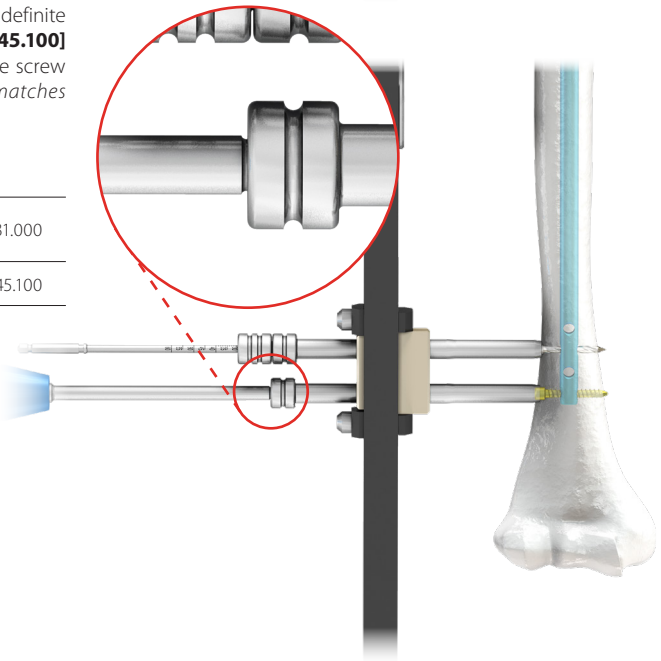




58 Insert the tip of the the screwdriver **[40.5031]** into head of the definite locking screw. Then advance both into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver.



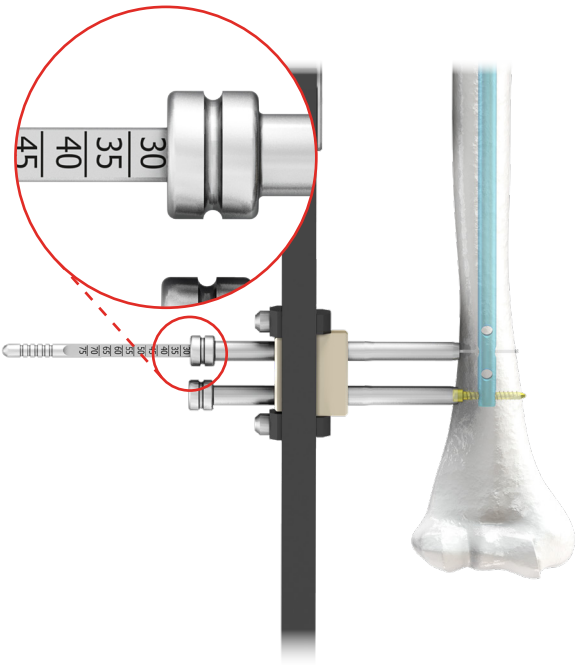


59 Insert the screw length measure **[40.3698.100]** through the protective guide until its hook reaches the cortex on the other side of the bone. Read the length of the locking screw on the B-D scale.

During the measurement the end of the protective guide should rest on the cortex bone.

Remove screw length measure.
Leave protective guide in the hole of the targeter slider.

40.3698.100

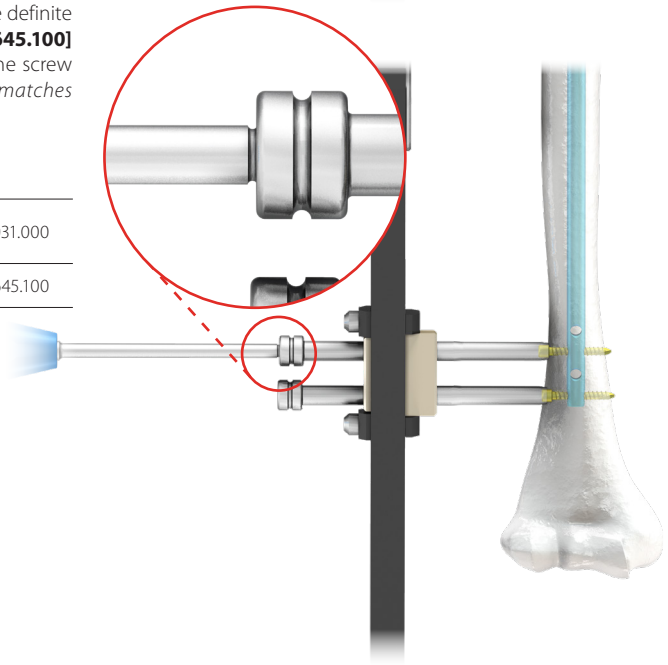


60 Insert the tip of the screwdriver **[40.5031]** into the head of the definite locking screw. Then advance both into the protective guide **[40.3645.100]** and insert the locking screw in the prepared hole until the head of the screw reaches the cortex bone *(the groove on the screwdriver shaft matches the edge of the protective guide)*.

Remove the screwdriver and protective guide.

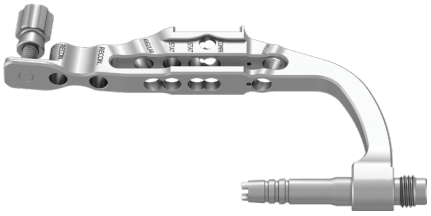
40.5031.000

40.3645.100



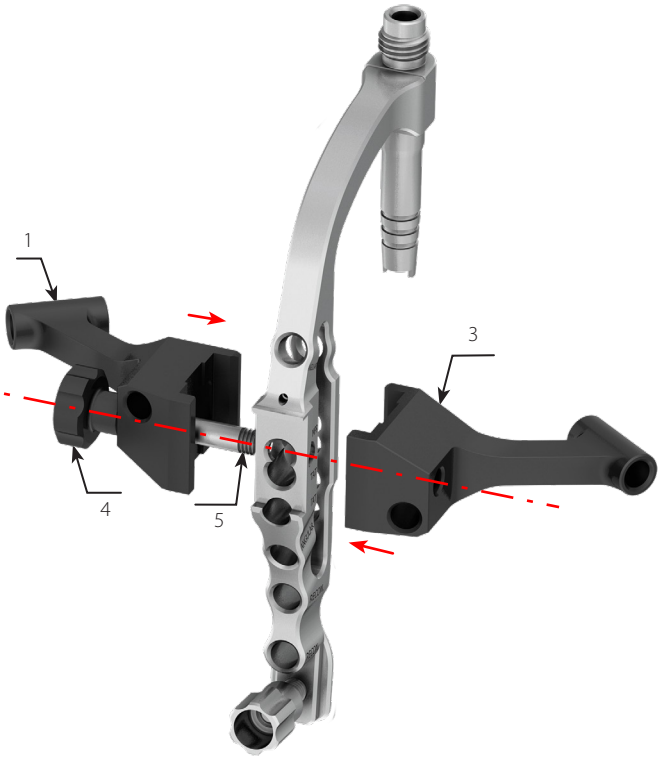
IV.11. PROXIMAL LOCKING OF LONG RECONSTRUCTION HUMERAL NAIL

In order to lock reconstruction humeral nail, it is necessary to mount the angular targeter **[40.5024]** to the humeral targeter B **[40.5030.100]** as showed in the picture. Insert threaded shaft *(5)* of the angular positioner I *(1)* into lateral hole of the humeral targeter B **[40.5030.100]** then into the connecting hole of angular positioner II *(3)*. Connect parts by tightening up the nut *(4)*.



40.5030.100

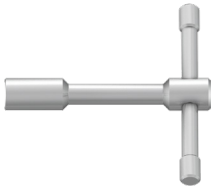
40.5024.000



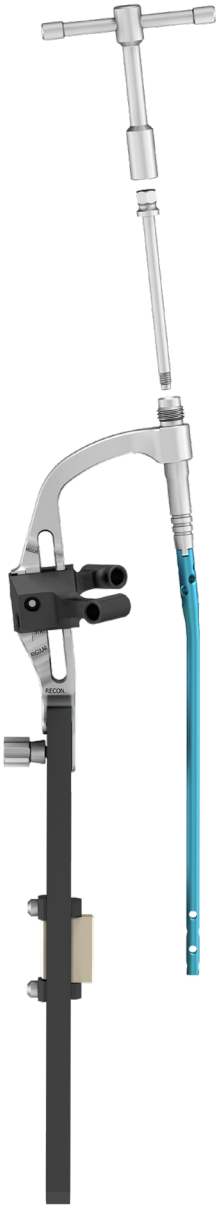
61 Using the socket wrench S11 **[40.3648]** and the connecting screw **[40.5023.100]** mount the intramedullary nail to the humeral targeter B **[40.5030.100]**.

Properly installed nail shall be positioned parallel to the arm of targeter B.

40.5023.100



40.3648.000



62 Connect the impactor-extractor **[40.3665]** to the humeral targeter B **[40.5030.100]**.

Use mallet **[40.3667]** to insert the nail into the medullary canal as intended.

Use guide rod 1.8/500 **[40.5025]** to insert the cannulated nail into the medullary canal. The solid nail is inserted directly into the medullary canal *(without the use of the rod)*.

Install the impactor-extractor to the targeter.
Remove guide rod *(if was used)*.


40.3665.000


40.3667.000

40.5025.000

63 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]**. Mark on the skin the entry point on the skin for the locking screw, make an adequate incision through soft tissues approx. 1.5cm in length. Advance the protective guide together with the trocar so as to put its end as close to cortex as possible and mark the entry point for the drill.

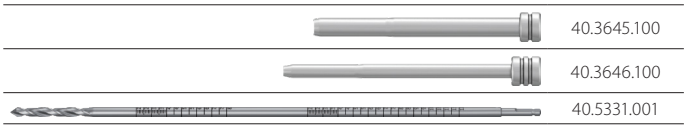
Remove the trocar.
Leave the protective guide in the hole of the targeter.

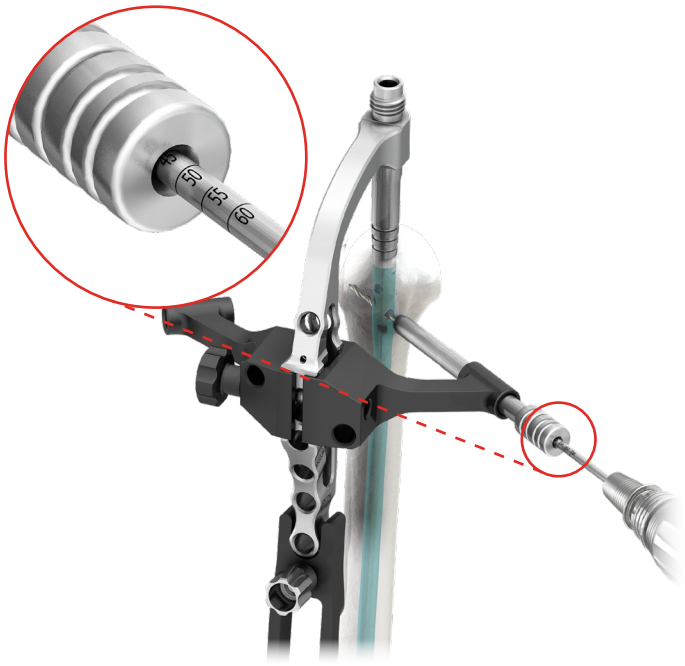

40.3645.100


40.3647.000

64 Insert the drill guide 6.5/3.5 **[40.3646.100]** into the protective guide **[40.3645.100]**. Mount the drill 3.5/240 **[40.5331.001]** on the surgical drive and advance it through the drill guide. Drill the hole for locking screw under the X-Ray control.

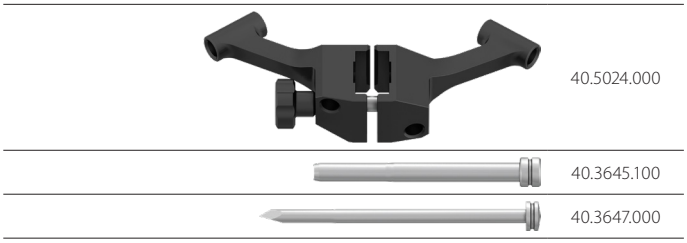
Leave the protective guide with the drill and the drill guide in the hole of the targeter.





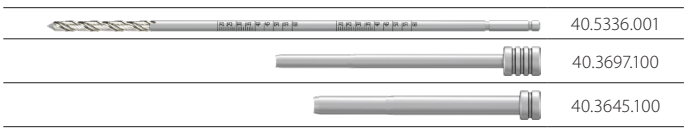
65 Insert the protective guide **[40.3645.100]** with the trocar 6.5 **[40.3647]** into the next hole of the angular targeter **[40.5024]**. Mark on the skin the entry point for the locking screw and make the adequate incision through the soft tissues approx. 1.5cm in length. Insert the protective guide together with the trocar so its end rests on the cortex and mark the entry point for the drill.

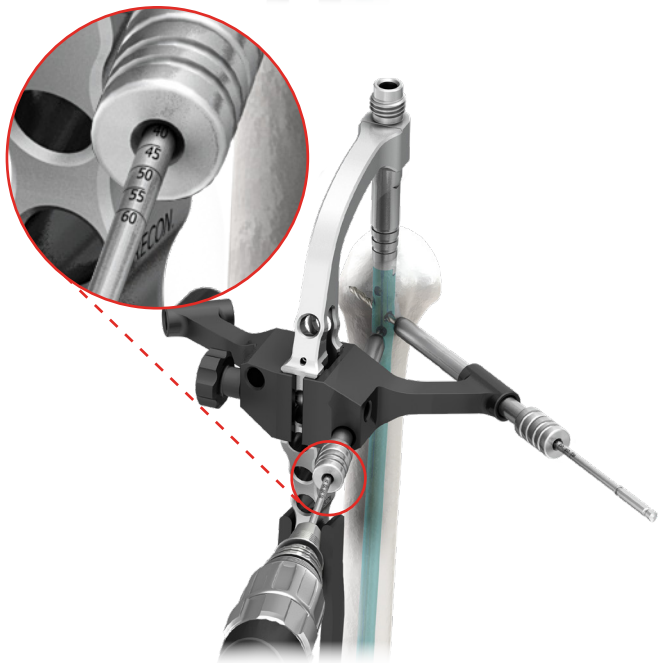
Remove the trocar.
Leave the protective guide in the hole of the targeter.



66 In case of nail locking by proximal locking screws 4.5 **[1.1653.xxx]** use the drill with scale 4.5/240 **[40.5336.001]** to ream the hole in the first bone cortex *(first: insert the drill guide 6.5/4.5* ***[40.3697.100]*** *into the protective guide 9.0/6.5* ***[40.3645.100]****)*.

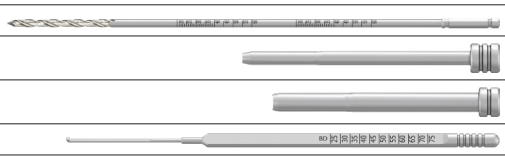
Remove the drill and the drill guide.
Leave the protective guide in the hole of the targeter.





67 Remove the drill **[40.5331.001]** and the drill guide 6.5/3.5 **[40.3646.100]** from the hole of the targeter. Leave the protective guide **[40.3645.100]** in place. Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on B-D scale. During the measurement the end of the protective guide should rest on the cortex bone.

Remove the screw length measure.
Leave the protective guide in hole of the targeter.

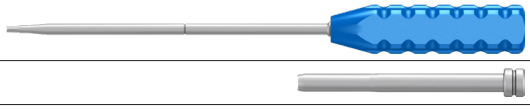


40.5331.001
40.3646.100
40.3645.100
40.3698.100

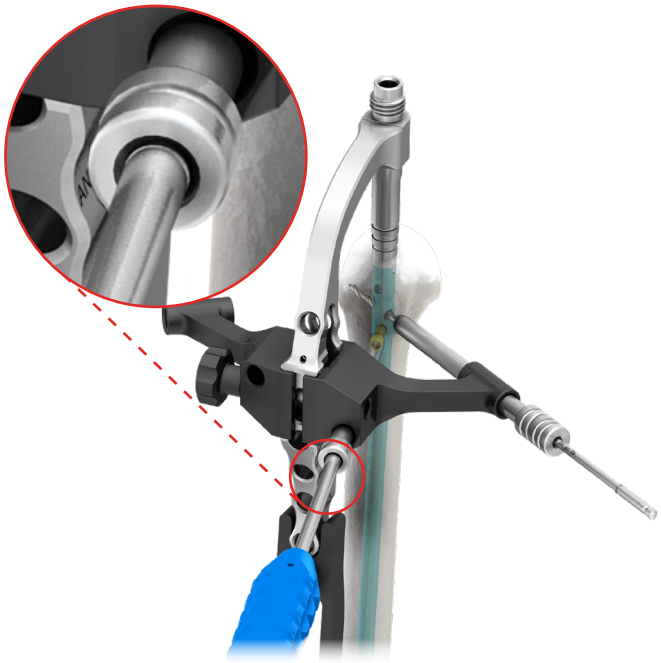
68 Insert the tip of the the screwdriver **[40.5031]** into the socket of locking screw:
- 4.5 in case of standard locking; or
- 5.0 in case of locking in threaded hole of the nail.

Then insert both into the protective guide **[40.3645.100]** and carefully screw the locking screw in the prepared hole *(until the groove on the screwdriver shaft matches the edge of the protective guide).*

Remove the screwdriver.
Leave the protective guide.

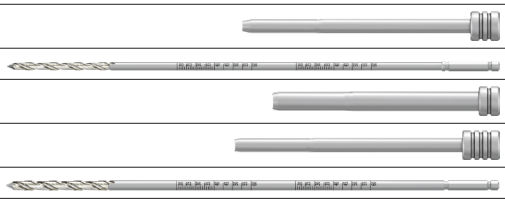


40.5031.000
40.3645.100

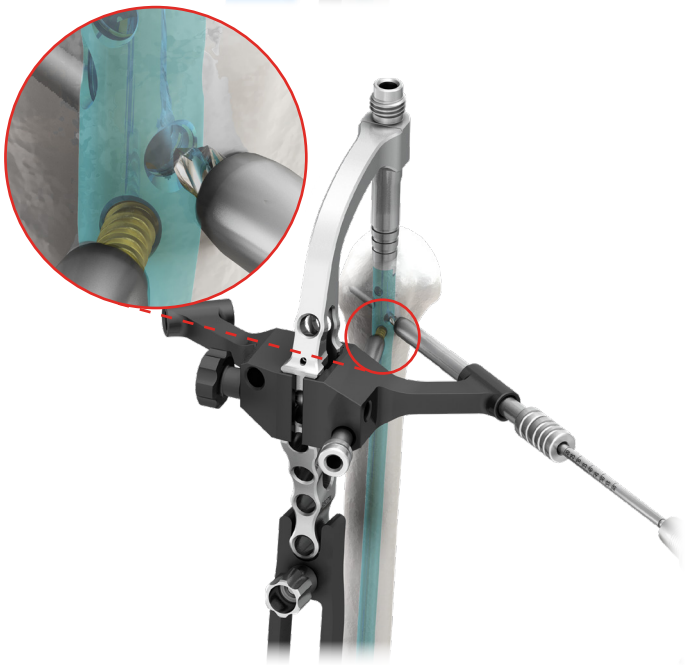


69 Remove the drill guide 6.5/3.5 **[40.3646.100]** and the drill with scale 3.5/240 **[40.5331.001]** from the first hole. Leave the protective guide in place. I nsert the drill guide 6.5/4.5 **[40.3697.100]** into protective guide. Advance the drill with scale 4.5/240 **[40.5336.001]** into the protective guide to widen hole in the first cortex layer.

Remove the drill and the drill guide.
Leave the protective guide in the targeter hole.



40.3646.100
40.5331.001
40.3645.100
40.3697.100
40.5336.001



70 Remove the drill with scale 3.5/240 **[40.5331.001]** and the drill guide 6.5/3.5 **[40.3646.100]** from the hole of the targeter. Leave protective guide **[40.3645.100]** in place. Insert the screw length measure **[40.3698.100]** through the protective guide **[40.3645.100]** into the drilled hole until its tip reaches the end of the hole. Read the length of the locking screw on B-D scale.

Remove the screw length measure.
Leave the protective guide in hole of the targeter.


40.5331.001


40.3646.100


40.3645.100


40.3698.100

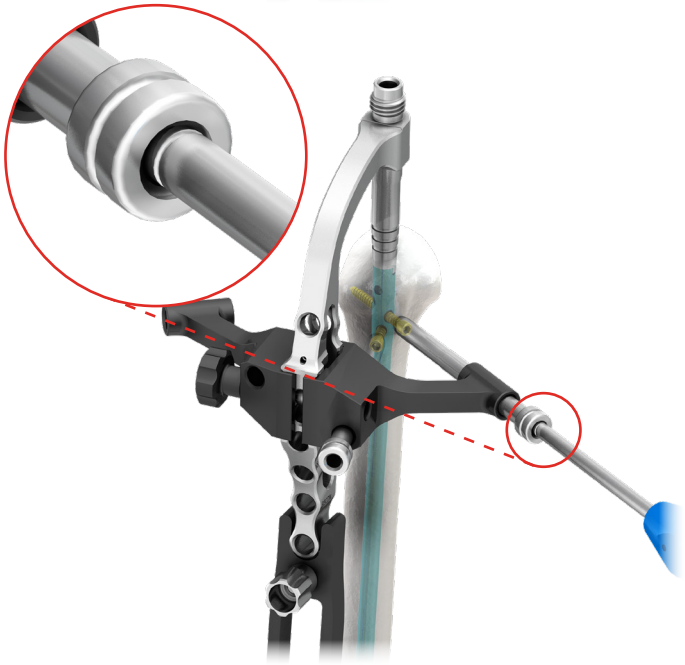
71 Insert the tip of the the screwdriver **[40.5031]** into the socket of locking screw:
- 4.5 in case of standard locking; or
- 5.0 in case of locking in threaded hole of the nail.

Then advance both into the protective guide **[40.3645.100]** and carefully insert the locking screw in the prepared hole *(until the groove on the screwdriver shaft matches the edge of the protective guide).*

Remove the screwdriver and protective guide.


40.5031.000


40.3645.100



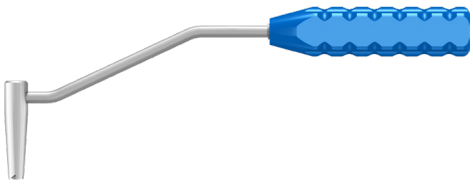
In order to enable locking the nail in other proximal holes, it is recommended *(after drilling the first hole and checking the correctness of the process)* to leave the drill in the hole and start locking the rest of holes or to lock the nail, and to leave the protective guide on the head of locking screw in order to improve the stability of the system: nail – targeter. Continue nail locking as specified in steps 63-71.

IV.12. DISTAL LOCKING OF THE NAIL BY "FREEHAND" TECHNIQUE

With this technique, an image intensifier is used to identify the entry points for the drill and to control the drilling process. It is recommended to use angular attachment with the surgical drive while drilling the holes, so that surgeon's hands are not directly exposed to X-Rays. After marking the entry points on the skin, incisions are made in the marked places through the soft tissues, each about 1.5cm in length.

72 Using X-Ray control place the targeter D **[40.1344]** in line to the nail hole. The centers of the holes in the targeter and the nail have to match. The teeth of the targeter have to be sink into the cortex. Insert the short trocar 7 **[40.1354]** into the hole in the targeter D, advance it until it reaches the cortex and mark the entry point for the drill.

Remove the trocar.
Leave the targeter D in place.



40.1344.000

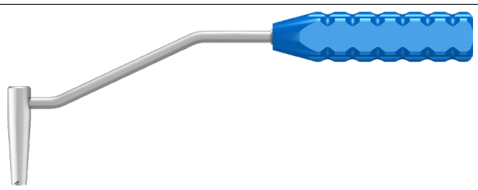
40.1354.000

73 Drill the hole for locking screw insertion.

OPTION I
Implantation 8 or 9mm nails *(with the use of 4.5mm screws)*.
Insert the drill guide short 7/3.5 **[40.1358]** into the targeter D **[40.1344]**. Lead 3.5/240 drill **[40.5331.001]** in drill guide and drill the hole in the humerus through both cortex layers.

OPTION II
Implantation 6 or 7mm nails *(with the use of 3.5mm screws)*.
Insert the drill guide 7/2.8 **[40.3670]** into the targeter D **[40.1344]**. Advance the drill with scale 2.8/240 **[40.5332.001]** in drill guide, drill the hole in the humerus through both cortex layers.

Remove the drill and drill guide.
Leave the targeter D.



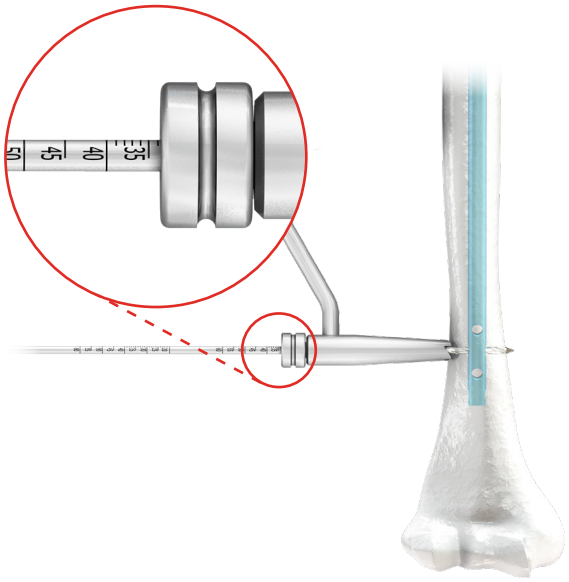
40.1344.000

40.1358.000

40.5331.001

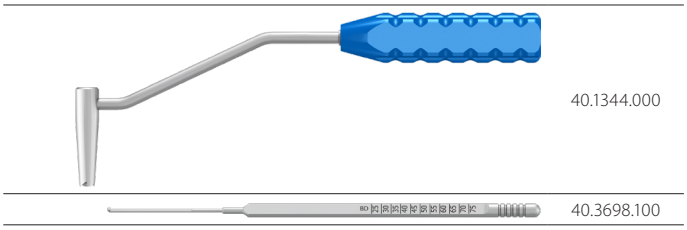
40.3670.000

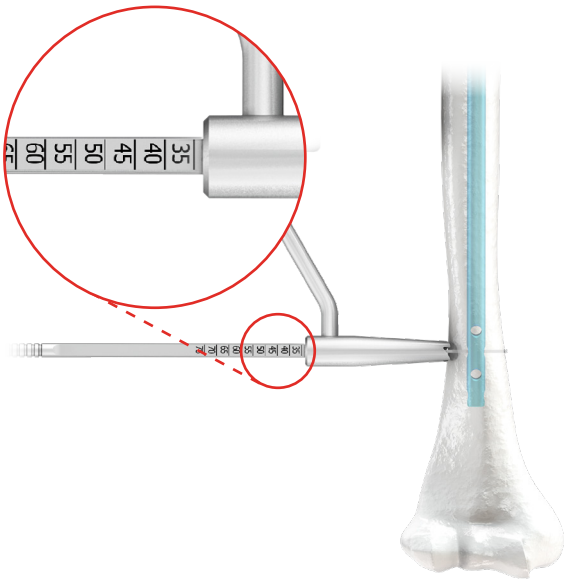
40.5332.001



74 Insert the screw length measure **[40.3698.100]** through the hole of the targeter D **[40.1344]** into the drilled hole until its hook reaches the cortex on the other side of the bone. Read the length of the locking screw on the scale D.

Remove the screw length measure.
Leave the targeter D in place.

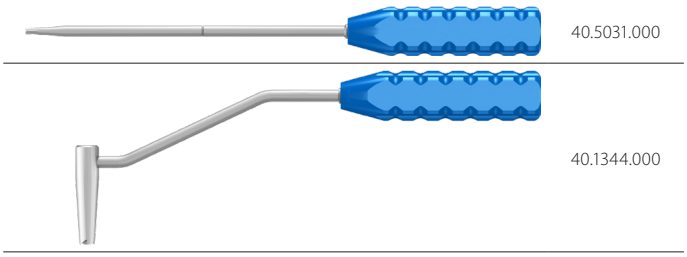




75 Insert the tip of the screwdriver **[40.5031]** into the socket of the defined locking screw. Then advance such system into the hole in the targeter D **[40.1344]** and insert the locking screw into the prepared hole until the head of the screw reaches the cortex bone.

Remove the screwdriver and the targeter D.

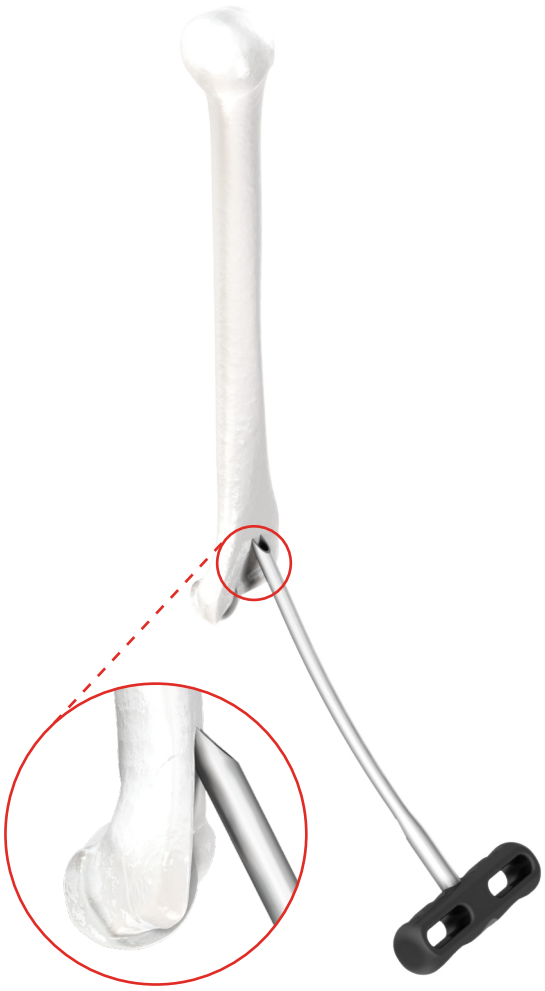
In order to lock the nail in the other distal hole repeat the steps 72 to 75.



IV.13. RETROGRADE NAIL IMPLANTATION

Medullary canal preparation

Having determined the insertion point for the nail, perform soft tissues incision. Then use the curved awl to penetrate the cortex. Depending on the equipment of the operating theater, an operator may use a different technique to open the medullary canal.

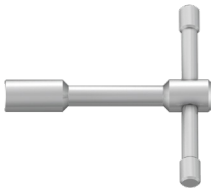


When preparing the medullary canal for retrograde nail insertion and further locking of the nail, follow the technique described for proximal nail insertion.

IV.14. NAIL EXTRACTION

76 Use the the screwdriver **[40.5031]** to remove the end cap or compression screw from the nail shaft. Using the socket wrench S11 **[40.3648]** insert the connector M7/M16 **[40.4751]** into the threaded hole in the nail.


40.5031.000


40.3648.000


40.4751.000

77 Using the screwdriver unscrew all the locking screws. Attach the extractor-impactor **[40.3665]** to connector and using the mallet **[40.3667]** extract the nail from the medullary canal.


40.3665.000


40.3667.000

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