

*instruction*

# INTRAMEDULLARY OSTEOSYNTHESIS OF FEMUR

IMPLANTS ◦  
INSTRUMENT SET 40.5090 ◦  
SURGICAL TECHNIQUE ◦

**CHARFIX** *system*



# 24E

**CE** 0197  
ISO 9001  
ISO 13485

**ChM**®



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## I. INTRODUCTION

**CHARFIX system** provides following methods of intramedullary fixation:

- Reconstructive,
- Compressive, dynamic, static,
- Reversed /condylar approach/.

Each fixation method of **CHARFIX system** comes with:

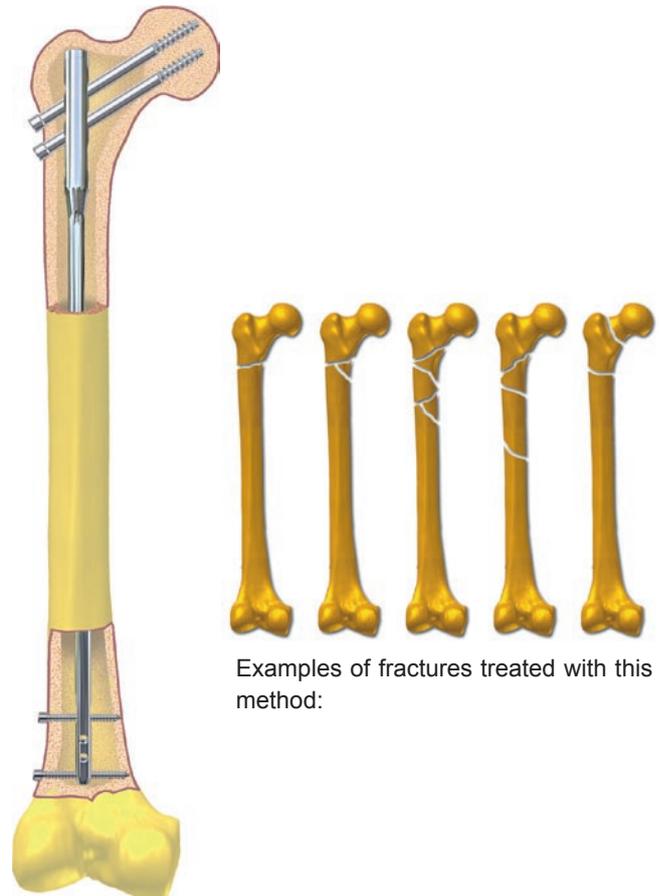
- adequate selection of implants (intramedullary nails, screws, locking screws),
- instrument sets for implants insertion and removal,
- instructions for use (surgical technique).

### I.1. RECONSTRUCTIVE, PERTROCHANTERIC METHOD

Reconstruction nails are used for intramedullary fixation of proximal femur neck or trochanteric fractures.

Angular position of reconstructive screws gives anatomical position of the head and trochanteric region against the femoral shaft. The nail comes in two versions: right nail for right femur, left nail for left femur.

Position of the implants in femur:

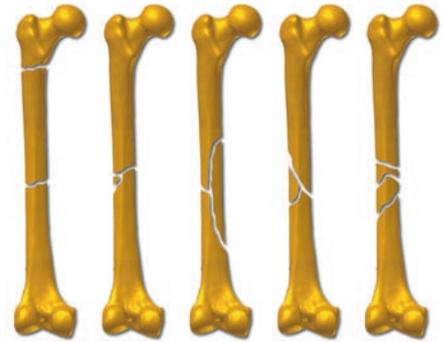


Examples of fractures treated with this method:

To fix the femoral fracture fragments with pertrochanteric method use:

- right nail for fixation of the left femur fractures
- left nail for fixation of the right femur fractures

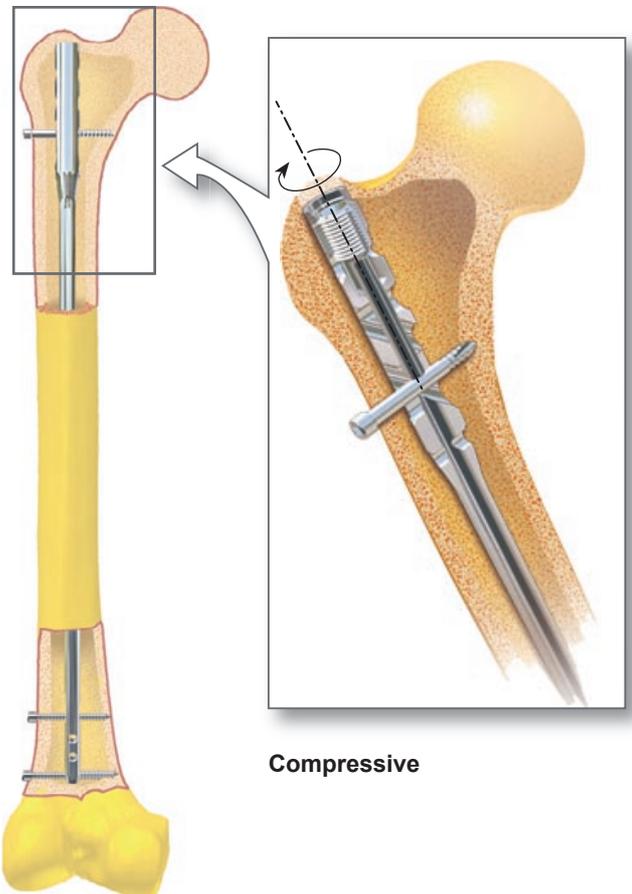
Position of implants in femur:



Examples of fractures treated with this method:

## I.2. COMPRESSIVE, DYNAMIC AND STATIC METHOD

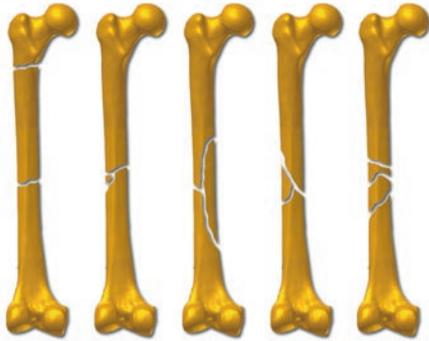
Compressive lockings are used in the intramedullary fixations of femoral shaft fractures, providing that fractures are not closer than 3cm from locking screw. Nail design allows treatment with the compressive, dynamic and static method.



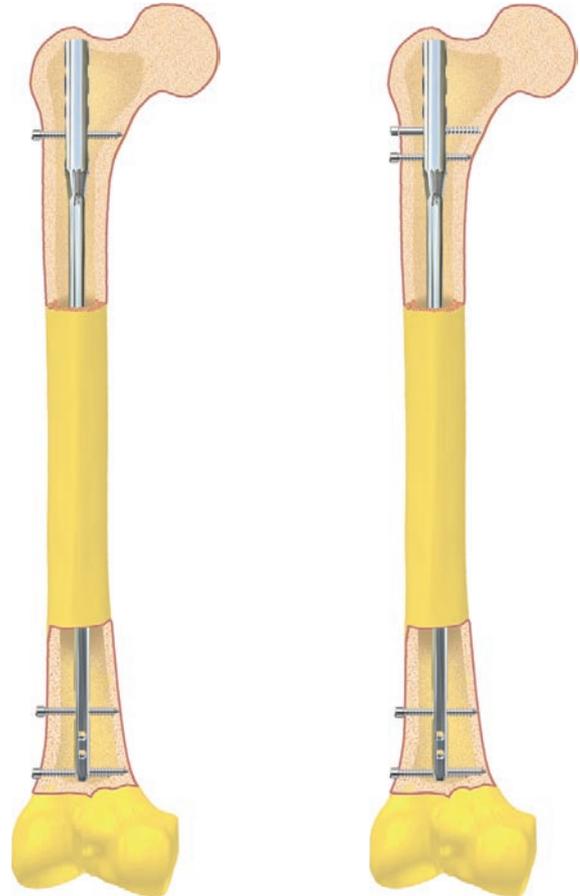
Compressive

In static locking, when needed, the proximal screw can be used to provide better locking.

Position of implants in femur

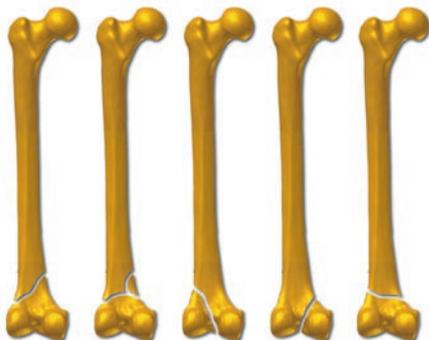


Examples of femoral shaft fractures treated with this method:

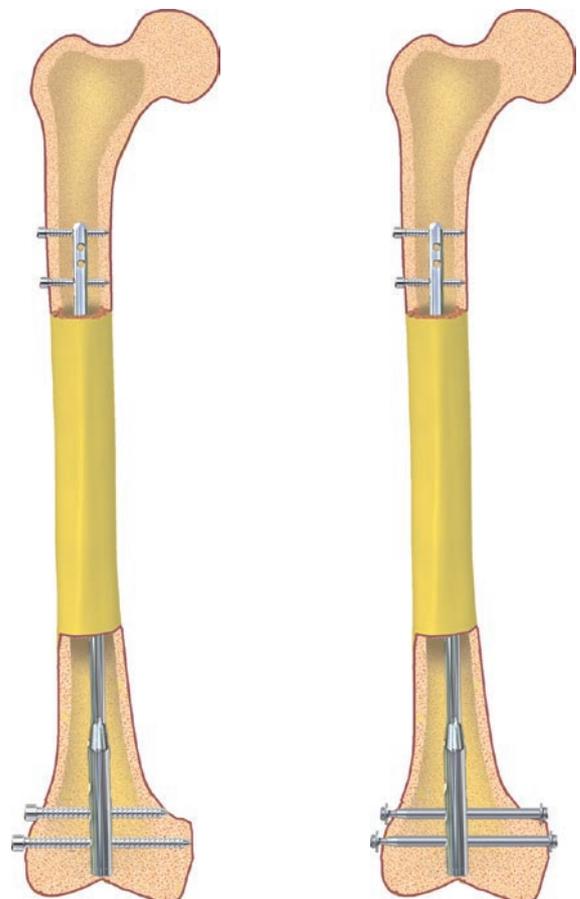


### I.3. REVERSED (CONDYLAR APPROACH)

Intramedullary nails with condylar approach enable fixation in the distal part of femur in case if any other method (reconstructive, compressive, dynamic, static) cannot be used. The reversed method can be used if prosthesis or other implant is located in the femur proximal or in case of condyle multifragmental fracture



Examples of femoral shaft fractures treated with this method:



II. IMPLANTS

II.1. Implants of Reconstructive, Compressive and Reversed Method

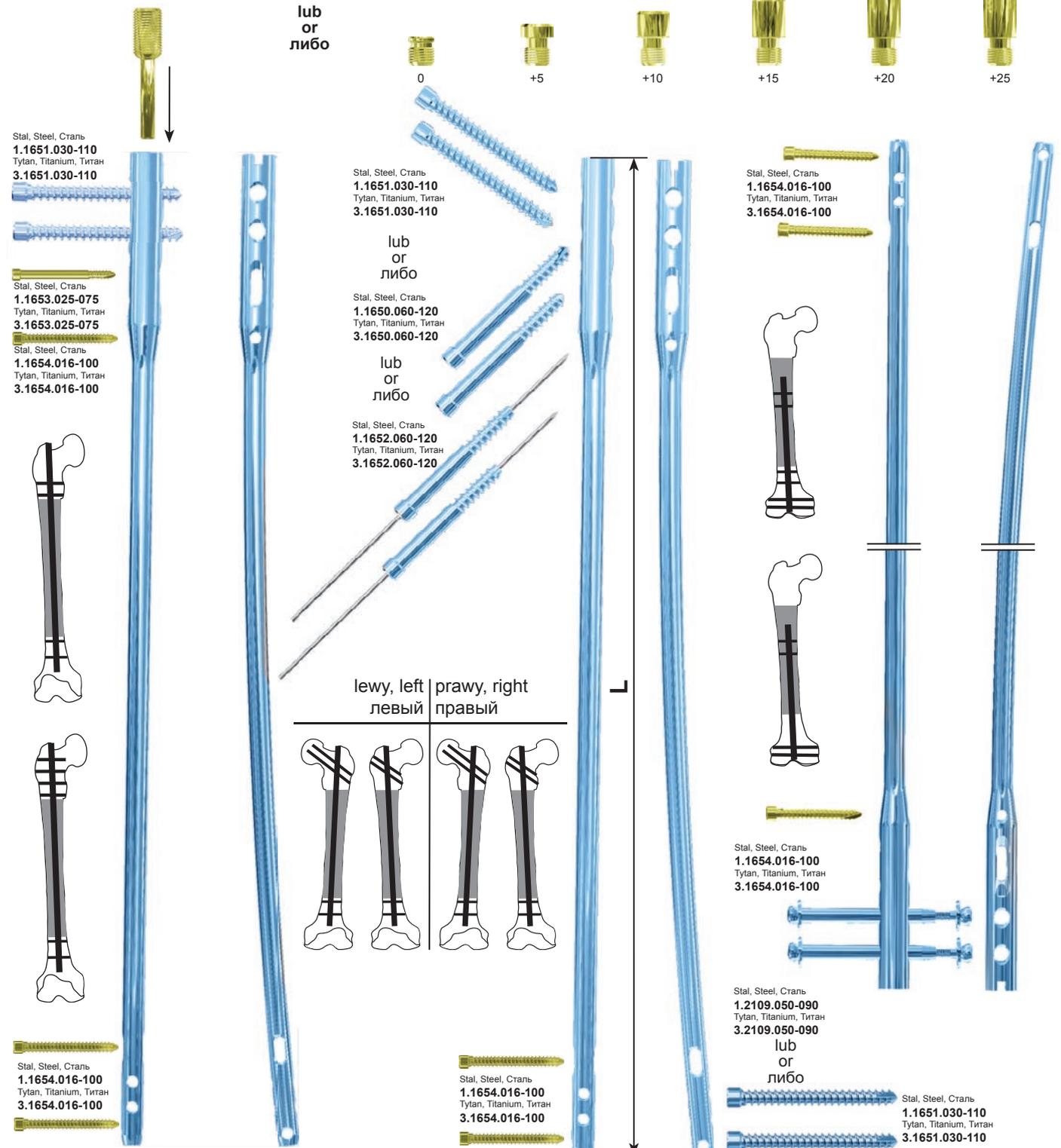
Śruba kompresyjna  
Compression screw

Винт компрессионный

Stal, Steel, Сталь	Tytan, Titanium, Титан
1.2106.007	3.2106.007

Śruba zaślepiająca M10x1 · End cap M10x1 · Винт слепой M10x1

Stal, Steel, Сталь 1.2104.300	Stal, Steel, Сталь 1.2104.305	Stal, Steel, Сталь 1.2104.310	Stal, Steel, Сталь 1.2104.315	Stal, Steel, Сталь 1.2104.320	Stal, Steel, Сталь 1.2104.325
Tytan, Titanium, Титан 3.2104.300	Tytan, Titanium, Титан 3.2104.305	Tytan, Titanium, Титан 3.2104.310	Tytan, Titanium, Титан 3.2104.315	Tytan, Titanium, Титан 3.2104.320	Tytan, Titanium, Титан 3.2104.325



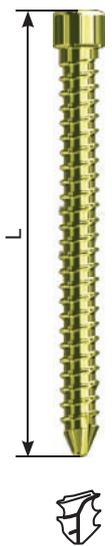
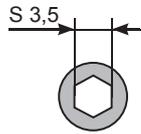
Metoda kompresyjna  
compression method  
компрессионный метод

Metoda rekonstrukcyjna  
reconstruction method  
реконструктивный метод

Metoda wsteczna  
reverse method  
ретроградный метод

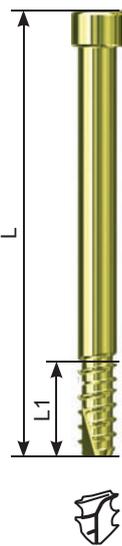
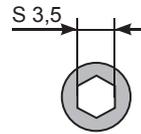


**Wkręt blokujący Ø4,5**  
**Distal screw Ø4.5**  
**Блокирующий винт Ø4,5**



Nr katalogowy, Catalogue no., № по кат.		
L [mm]	STAL, Steel, Сталь	TYTAN, Titanium, Титан
16	1.1654.016	3.1654.016
18	1.1654.018	3.1654.018
20	1.1654.020	3.1654.020
22	1.1654.022	3.1654.022
24	1.1654.024	3.1654.024
25	1.1654.025	3.1654.025
26	1.1654.026	3.1654.026
28	1.1654.028	3.1654.028
30	1.1654.030	3.1654.030
35	1.1654.035	3.1654.035
40	1.1654.040	3.1654.040
45	1.1654.045	3.1654.045
50	1.1654.050	3.1654.050
55	1.1654.055	3.1654.055
60	1.1654.060	3.1654.060
65	1.1654.065	3.1654.065
70	1.1654.070	3.1654.070
75	1.1654.075	3.1654.075
80	1.1654.080	3.1654.080
85	1.1654.085	3.1654.085
90	1.1654.090	3.1654.090
95	1.1654.095	3.1654.095
100	1.1654.100	3.1654.100

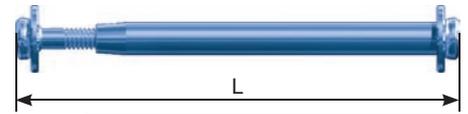
**Wkręt blokujący trzonowy Ø4,5**  
**Proximal screw Ø4.5**  
**Блокирующий проксимальный Ø4,5**



Nr katalogowy, Catalogue no., № по кат.			
L [mm]	L1 [mm]	STAL, Steel, Сталь	TYTAN, Titanium, Титан
25	12	1.1653.025	3.1653.025
30	12	1.1653.030	3.1653.030
35	16	1.1653.035	3.1653.035
40	16	1.1653.040	3.1653.040
45	16	1.1653.045	3.1653.045
50	18	1.1653.050	3.1653.050
55	18	1.1653.055	3.1653.055
60	18	1.1653.060	3.1653.060
65	20	1.1653.065	3.1653.065
70	20	1.1653.070	3.1653.070
75	20	1.1653.075	3.1653.075
80	22	1.1653.080	3.1653.080
85	22	1.1653.085	3.1653.085
90	22	1.1653.090	3.1653.090

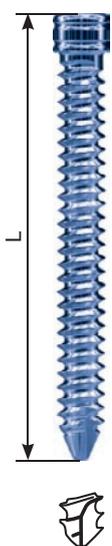
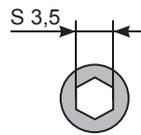
**Zestaw blokujący Ø6,5**  
**Blocking set Ø6.5**  
**Блокирующий набор Ø6,5**

Komplet / Set / Комплект



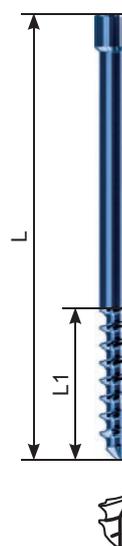
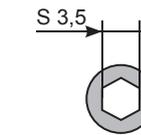
L [mm]	Zakres Range Диапазон	STAL, Steel, Сталь	TYTAN, Titanium, Титан
50	50-65 [mm]	1.2109.050	3.2109.050
60	60-75 [mm]	1.2109.060	3.2109.060
70	70-85 [mm]	1.2109.070	3.2109.070
80	80-95 [mm]	1.2109.080	3.2109.080
90	90-105 [mm]	1.2109.090	3.2109.090

**Wkręt blokujący Ø6,5**  
**Distal screw Ø6.5**  
**Блокирующий винт Ø6,5**



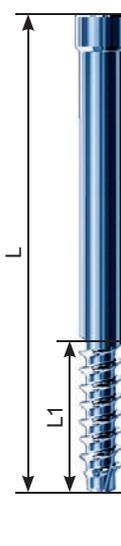
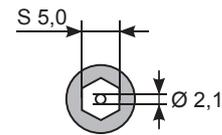
Nr katalogowy, Catalogue no., № по кат.		
L [mm]	STAL, Steel, Сталь	TYTAN, Titanium, Титан
30	1.1651.030	3.1651.030
35	1.1651.035	3.1651.035
40	1.1651.040	3.1651.040
45	1.1651.045	3.1651.045
50	1.1651.050	3.1651.050
55	1.1651.055	3.1651.055
60	1.1651.060	3.1651.060
65	1.1651.065	3.1651.065
70	1.1651.070	3.1651.070
75	1.1651.075	3.1651.075
80	1.1651.080	3.1651.080
85	1.1651.085	3.1651.085
90	1.1651.090	3.1651.090
95	1.1651.095	3.1651.095
100	1.1651.100	3.1651.100
105	1.1651.105	3.1651.105
110	1.1651.110	3.1651.110

**Wkręt rekonstrukcyjny Ø6,5**  
**Reconstructive screw Ø6.5**  
**Реконструктивный винт Ø6,5**



Nr katalogowy, Catalogue no., № по кат.			
L [mm]	L1 [mm]	STAL, Steel, Сталь	TYTAN, Titanium, Титан
60	25	1.1650.060	3.1650.060
65	25	1.1650.065	3.1650.065
70	25	1.1650.070	3.1650.070
75	25	1.1650.075	3.1650.075
80	25	1.1650.080	3.1650.080
85	25	1.1650.085	3.1650.085
90	25	1.1650.090	3.1650.090
95	32	1.1650.095	3.1650.095
100	32	1.1650.100	3.1650.100
105	32	1.1650.105	3.1650.105
110	32	1.1650.110	3.1650.110
115	32	1.1650.115	3.1650.115
120	32	1.1650.120	3.1650.120

**Wkręt rekonstrukcyjny kaniulowany**  
**Reconstructive cannulated screw**  
**Винт реконструктивный канюлированный**



Nr katalogowy, Catalogue no., № по кат.			
L [mm]	L1 [mm]	STAL, Steel, Сталь	TYTAN, Titanium, Титан
60	25	1.1652.060	3.1652.060
65	25	1.1652.065	3.1652.065
70	25	1.1652.070	3.1652.070
75	25	1.1652.075	3.1652.075
80	25	1.1652.080	3.1652.080
85	25	1.1652.085	3.1652.085
90	25	1.1652.090	3.1652.090
95	32	1.1652.095	3.1652.095
100	32	1.1652.100	3.1652.100
105	32	1.1652.105	3.1652.105
110	32	1.1652.110	3.1652.110
115	32	1.1652.115	3.1652.115
120	32	1.1652.120	3.1652.120

### III. INSTRUMENT SET

#### III.1. Introduction

Fixation of the femoral fractures with reconstructive, compressive, dynamic or static method is carried out with single instrument set. When using the above mentioned methods, it is also required to have a set of flexible intramedullary reamers in following diameters:

8 [40.3854], 8.5 [40.3855], 9 [40.3856], 9.5 [40.3857], 10 [40.3858], 10.5 [40.3859], 11 [40.3860], 11.5 [40.3861], 12 [40.3862], 12.5 [40.3863], 13 [40.3864], 13.5 [40.3865], 14 [40.3866], 14.5 [40.3867], 15 [40.3868] and surgical drive or handle for manual reaming. The operation is to be performed on operating table equipped with the X-Ray image intensifier.

#### III.2. Instrument set for reconstructive, compressive method [40.5060]

The set of instruments and devices are placed on a stand with a lid to enable sterilization and transport to the operating suite.

Lp.	Nr katalogowy Catalogue no. № по кат.	Nazwa	Name	Название	Szt.
1	40.5091.000	Ramię celownika	Arm target	Плечо целенаправителя	1
2	40.5097.000	Celownik 135	Target 135	Целенаправитель 135	1
3	40.5093.000	Celownik dalszy D	Distal target D	Целенаправитель дистальный Д	1
4	40.5094.000	Śruba łącząca M10x1 L=55	Connecting screw M10x1 L=55	Винт соединительный M10x1 L=55	1
5	40.5095.000	Śruba łącząca M10x1 L=66	Connecting screw M10x1 L=66	Винт соединительный M10x1 L=66	1
6	40.5096.000	Śruba kompresyjna	Compression screw	Компрессионный винт	1
7	40.5098.000	Miarka długości gwoździ	Nail length measure	Измеритель длины стержня	1
8	40.3327.000	Trokar 9	Trocar 9	Троакар 9	1
9	40.3328.000	Prowadnica ochronna 11/9	Protective guide 11/9	Направитель-протектор 11/9	2
10	40.3329.000	Prowadnica wiertła 9/6,5	Drill guide 9/6.5	Направитель сверла 9/6,5	1
11	40.3330.000	Prowadnica wiertła 9/4,5	Drill guide 9/4.5	Направитель сверла 9/4,5	1
12	40.3331.000	Prowadnica Kirschnera	Kirschner guide	Направитель Киршнера	1
13	40.3332.000	Miarka długości wkrętów rekonstrukcyjnych	Reconstruction screw length measure	Измеритель длины реконструктивных винтов	1
14	40.3333.000	Gwóźdź Kirschnera 2,0/380	Kirschner wire 2.0/380	Спица Киршнера 2,0/380	4
15	40.3614.000	Prowadnica ochronna 9/6,5	Protective guide 9/6.5	Направитель-протектор 9/6,5	2
16	40.3615.000	Prowadnica wiertła 6,5/3,5	Drill guide 6.5/3.5	Направитель сверла 6,5/3,5	2
17	40.3616.000	Ustawiak 9/4,5	Set block 9/4.5	Инструмент установочный 9/4,5	2
18	40.3617.000	Trokar 6,5	Trocar 6.5	Троакар 6,5	1
19	40.3696.000	Prowadnica wiertła 6,5/4,5	Drill guide 6.5/4.5	Направитель сверла 6,5/4,5	1
20	40.1374.000	Miarka długości wkrętów	Screw length measure	Измеритель длины винтов	1
21	40.5523.000	Szydło wygięte 8,0	Curved awl 8.0	Шило изогнутое 8,0	1
22	40.5507.000	Wbijak - wybijak	Impactor-extractor	Импактор-экстрактор	1
23	40.3667.000	Pobijak	Mallet	Пробойник	1
24	40.5071.000	Łącznik M10x1/M12	Connector	Соединитель	1
25	40.5526.000	Klucz S10	Wrench S10	Ключ S10	1
26	40.1348.000	Prowadnica rurkowa	Teflon pipe guide	Трубка-направитель	1
27	40.3925.580	Drut prowadzący 3,0/580	Guide rod 3.0/580	Спица-направитель 3,0/580	1
28	40.1351.000	Uchwyt drutu prowadzącego	Handle guide rod	Держатель направляющей проволоки	1
29	40.3604.000	Śrubokręt S 3,5	Screwdriver S 3.5	Отвертка S 3,5	1
30	40.5333.000	Wiertło ze skalą 4,5/350	Drill with scale 4.5/350	Сверло с измерительной шкалой 4,5/350	1
31	40.5330.000	Wiertło ze skalą 3,5/250	Drill with scale 3.5/250	Сверло с измерительной шкалой 3,5/250	2
32	40.2068.350	Wiertło 6,5/350	Drill 6.5/350	Сверло 6,5/350	1
33	40.3674.000	Wiertło kaniulowane 6,5/300	Cannulated drill 6.5/300	Сверло канолированное 6,5/300	1
34	40.3675.000	Wkrętak kaniulowany S 5,0/2,2	Cannulated screwdriver S 5.0/2.2	Отвертка канолированная S 5,0/2,2	1
35	40.3676.000	Miarka długości wkrętów kaniulowanych	Reconstruction screw length measure	Измеритель длины реконструктивных винтов	1
36	40.5065.009	Wkładka celująca 9,0	Insertion target 9.0	Направительный вкладыш 9,0	2
37	40.5065.011	Wkładka celująca 11,0	Insertion target 11.0	Направительный вкладыш 11,0	2
38	40.5074.000	Śrubokręt S 3,5	Screwdriver S	Отвертка S	1
39	40.5075.000	Prowadnik sworznia	Bolt guide	Направитель шпильки	1
40	40.1387.000	Wiertło 4,5/250	Drill 4.5/250	Сверло 4,5/250	1
41	40.1344.000	Celownik D	Target D	Направитель дистальный Д	1
42	40.1358.000	Prowadnica wiertła krótka 7/3,5	Drill guide short 7/3.5	Направитель сверла короткий 7/3,5	1
43	40.1354.000	Trokar krótki 7	Trocar short 7	Троакар короткий 7	1
44	40.3662.000	Prowadnica ochronna 11/9	Protective guide 11/9	Направитель-протектор 11/9	1
45	40.5099.500	Statyw	Stand	Подставка	1

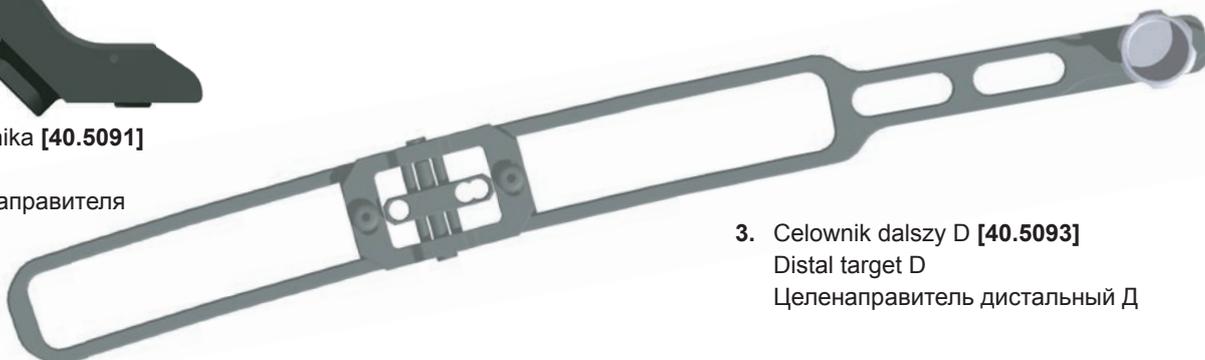
**40.5090.500**



1. Ramię celownika [40.5091]  
Arm target  
Плечо целенаправителя



2. Celownik 135 [40.5097]  
Target 135  
Целенаправитель 135



3. Celownik dalszy D [40.5093]  
Distal target D  
Целенаправитель дистальный Д



4. Śruba łącząca M10x1 L=55 [40.5094]  
Connecting screw M10x1 L=55  
Винт соединительный M10x1 L=55



6. Śruba kompresyjna [40.5096]  
Compression screw  
Компрессионный винт



5. Śruba łącząca M10x1 L=66 [40.5095]  
Connecting screw M10x1 L=66  
Винт соединительный M10x1 L=66



7. Miarka długości gwoździ [40.5098]  
Nail length measure  
Измеритель длины стержня



8. Trokar Ø9 [40.3327]  
Trocar 9  
Трокар 9



10. Prowadnica wiertła Ø9/Ø6,5 [40.3329]  
Drill guide 9/6.5  
Направитель сверла 9/6,5



9. Prowadnica ochronna Ø11/Ø9 [40.3328]  
Protective guide 11/9  
Направитель-протектор 11/9



11. Prowadnica wiertła Ø9/Ø4,5 [40.3330]  
Drill guide 9/4.5  
Направитель сверла 9/4,5



12. Prowadnica Kirschnera [40.3331]  
Kirschner guide  
Направитель Киршнера



13. Wzorec długości wkrętów rekonstrukcyjnych [40.3332]  
Reconstruction screw length measure  
Измеритель длины реконструктивных винтов



14. Gwoździć Kirschnera Ø2/380 [40.3333]  
Kirschner wire Ø2/380  
Спица Киршнера Ø2/380



**15. Prowadnica ochronna Ø9/Ø6,5 [40.3614]**  
Protective guide 9/6.5  
Направитель-протектор Ø9/Ø6,5



**16. Prowadnica wiertła Ø6,5/ Ø3,5 [40.3615]**  
Drill guide 6.5/3.5  
Направитель сверла 6,5/3,5



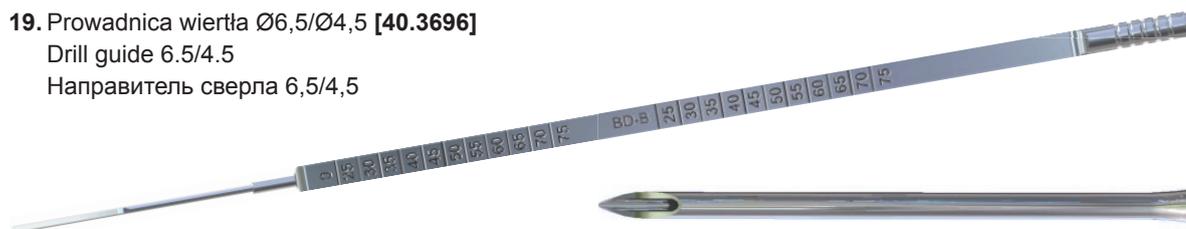
**17. Ustawiak Ø9/Ø4.5 [40.3616]**  
Set block 9/4.5  
Инструмент установочный 9/4,5



**18. Trokar Ø6,5 [40.3617]**  
Trocar 6.5  
Трокар 6,5



**19. Prowadnica wiertła Ø6,5/Ø4,5 [40.3696]**  
Drill guide 6.5/4.5  
Направитель сверла 6,5/4,5



**20. Miarka długości wkrętów [40.1374]**  
Screw length measure  
Измеритель длины винтов



**21. Szydło wygięte 8,0 [40.5523]**  
Curved awl 8.0  
Шило изогнутое 8,0



**22. Wbijak - wybijak [40.5507]**  
Impactor-extractor  
Импактор-экстрактор



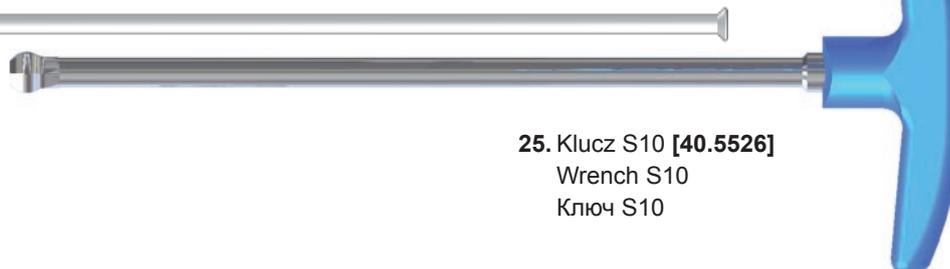
**23. Pobijak [40.3667]**  
Mallet  
Пробойник



**24. Łącznik M10x1/M12 [40.5071]**  
Connector M10x1/M12  
Соединитель M10x1/M12



**26. Prowadnica rurkowa [40.1348]**  
Teflon pipe guide  
Трубка-направитель



**25. Klucz S10 [40.5526]**  
Wrench S10  
Ключ S10

**27. Drut prowadzący Ø3,0/580 [40.3925.580]**  
Guide rod 3.0/580  
Спица-направитель 3,0/580



**28. Uchwyt drutu prowadzącego [40.1351]**  
Handle guide rod  
Держатель направляющей проволоки



**29. Śrubokręt S3,5 [40.3604]**  
Screwdriver S 3.5  
Отвертка S 3,5

**30. Wiertło ze skalą Ø4,5/350 [40.5333]**  
 Drill with scale 4.5/350  
 Сверло с измерительной шкалой 4,5/350

**31. Wiertło ze skalą Ø3,5/250 [40.5330]**  
 Drill with scale 3.5/250  
 Сверло с измерительной шкалой 3,5/250

**32. Wiertło Ø6,5 / 350 [40.2068.350]**  
 Drill 6.5/350  
 Сверло 6,5/350

**33. Wiertło kaniulowane Ø6,5/300 [40.3674]**  
 Cannulated drill 6.5/300  
 Сверло канюлированное 6,5/300

**34. Wkrętak kaniulowany S5,0/2,2 [40.3675]**  
 Cannulated screwdriver S5.0/2.2  
 Отвертка канюлированная S5,0/2,2

**35. Wzorzec długości wkrętów kaniulowanych [40.3676]**  
 Reconstruction screw lenght measure  
 Измеритель длины реконструктивных винтов

**36. Wkładka celująca 9,0. [40.5065.009]**  
 Insertion target 9.0  
 Целенаправительный вкладыш 9,0

**37. Wkładka celująca 11,0. [40.5065.011]**  
 Insertion target 11.0  
 Целенаправительный вкладыш 11,0

**39. Prowadnik sworznia [40.5075]**  
 Bolt guide  
 Направитель шпильки

**38. Śrubokręt S3,5 [40.5074]**  
 Screwdriver S3.5  
 Отвертка S3,5

**41. Celownik D [40.1344]**  
 Target D  
 Целенаправитель дистальный Д

**40. Wiertło Ø4,5 / 250 [40.1387]**  
 Drill 4.5/250  
 Сверло 4,5/250

**42. Prowadnica wiertła krótka Ø7/Ø3,5 [40.1358]**  
 Drill guide short 7/3.5  
 Направитель сверла короткий 7/3,5

**43. Trokar krótki Ø7 [40.1354]**  
 Trocar short 7  
 Троакар короткий 7

**44. Prowadnica ochronna Ø11/Ø9 [40.3662]**  
 Protective guide 11/9  
 Направитель-протектор Ø11/Ø9

**45. Statyw [40.5099]**  
 Stand  
 Подставка



## **IV. SURGICAL TECHNIQUE**

### **IV.1. METHODS: reconstructive, compressive, dynamic, static**

#### **IV.1.1. Introduction**

Tightly fitting the medullary canal is not necessary if the locking nail is used. In case of placing the nail without reaming the canal following diameters 8, 9, 10, 11 mm of the nail should be used. Nails with diameter 12, 13, 14 are used for the cases where reaming has to be done.

Please note, that the diameter of reamed canal has to be about 2mm wider than the diameter of the nail.

In every case, hole is to be made in proximal part of femur, 13 mm in diameter for the nails sizes 8, 9, 10, 11, 12, 13 mm or 14 mm in diameter for the nail 14 mm, and to 8 cm in depth.

It enables the insertion of proximal part, where the nail is made thicker. Decision about possible reaming after verifying the shape of canal and type of fracture shall be made by surgeon.

Reaming of medullary canal is not recommended for patients with chest injuries due to the risk of fat embolus.

When patient cannot be operated at the day of femoral fracture, it is recommended to apply strong traction for 2 to 3 days to spread the fragments. This considerably enables fracture reduction and nail insertion.

Placing patient on table with traction is integral part of the surgery.  
Presented method of intramedullary osteosynthesis requires radiological examination.

Each operating procedure must be carefully planned. X-Ray of the entire femur is essential in order to not overlook the injuries in its proximal or distal part.

It is especially important in cases of nailing the pathological subtrochanteric fractures. Special attention is to be made on concurrent femoral neck fractures or proximal epiphysis multi-fragmental fractures, and the possibility of theirs occurrence during the procedure of placing the nail. During the operation secondary fractures of main fragments may occur.

In such cases the dynamic stabilization has to be replaced by a static one.

The condition of hip joint is also very important. In advanced arthrosis or contracture fixation may be difficult or even impossible to perform.

In addition, it should be verify whether alloplasty of hip or knee has been performed on the fractured. The procedure has to be carried out on the operating table with traction with the patient placed supine or on the side. The side position enables the approach to the greater trochanter, which is especially important with overweight patients.

The supine position provides less favorable access to the grater trochanter, but makes all other stages of the operation considerably easier (especially rotary corrections).

In the presented method the supine position is recommended with traction applied behind the condyles of the operated femur.

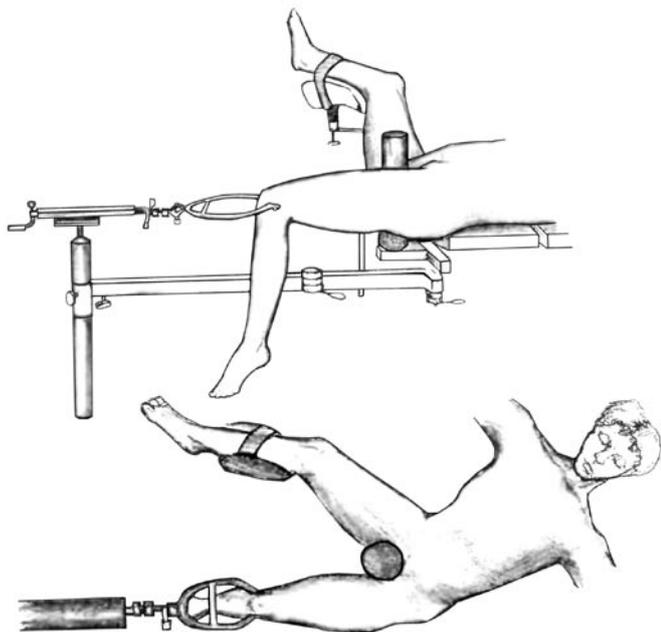


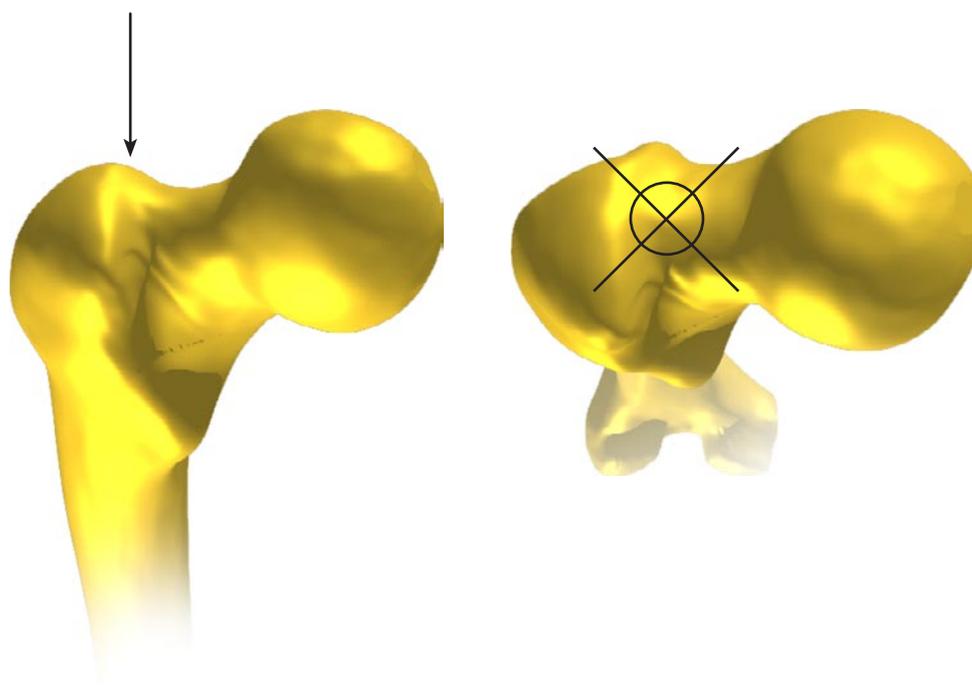
Fig. 1. Supine position for intramedullary osteosynthesis of femur.

Lateral surgical approach shall be applied, starting the incision near the tip of greater trochanter in line with the femoral shaft axis for 8cm. The incision should be longer for overweight patients. In the same direction an incision is made in fascia. Fibers of greater gluteal muscle are then split, thus providing approach to the tip of greater trochanter. The entry point for the nail should be located in line with the axis of medullary canal.

It can be found in practice in a following way.

If one finds the tip of greater trochanter then the insertion point is “a little bit paracentrally” and to the front in a place where one should feel small dale (fossa piriformis) with index finger (see Fig. 2)

Fig. 2 Entry point for femoral nail.

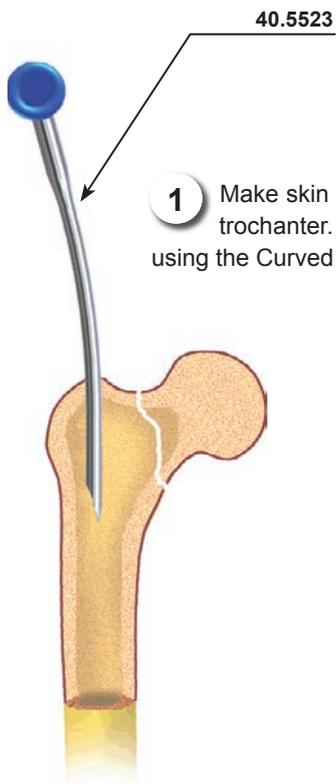


*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

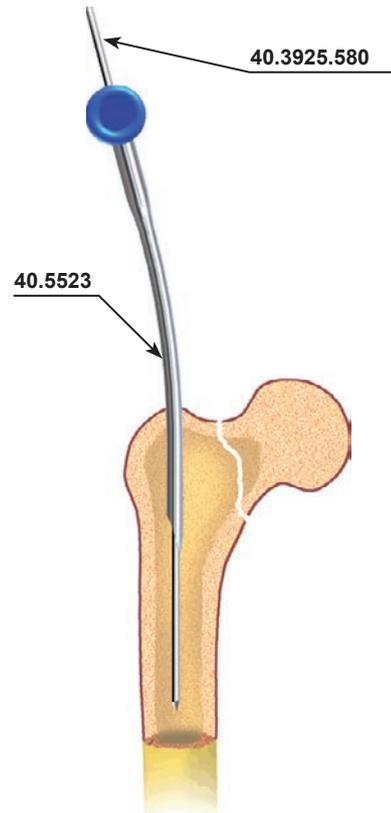
**ATTENTION!** The following paragraphs describe most important steps during insertion of intramedullary interlocking femur nails nevertheless it is not detailed instruction for use. The surgeon decides about choosing the surgical technique and its application in each individual case.

Based on X-Ray of fractured and healthy femur, the surgeon decides about the type of nail (length, diameter).

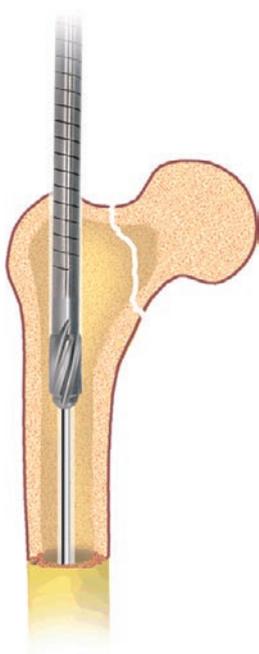
**IV.1.2. Preparation of medullary canal and nail insertion.**



**1** Make skin incision near the tip of greater trochanter. Open the medullary canal using the Curved Awl 8.0 [40.5523].



**2** After opening the canal insert the Guide Rod 3.0/580 [40.3925] to the required depth. Remove the Handle Guide Rod [40.1351].  
Remove the Guide Rod 3.0/580 and the Curved Awl.



**3** In case if medullary canal is reamed, gradually increase the diameter with steps of 0.5 mm, until the diameter 1.5 to 2.0 mm wider than the diameter of the femoral nail is reached, for the depth at least equal to the nail length (but not lesser).  
In both cases when the medullary canal was reamed or not the canal should be reamed using 13 or 14 reamer to the depth of approx. 8 cm

Remove the Flexible Reamer.

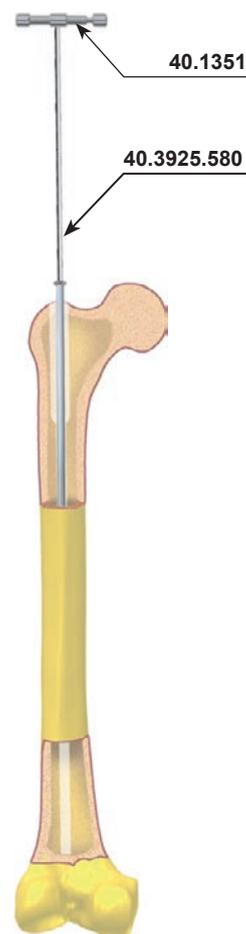
*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**NOTE!** Steps [4] and [5] are applicable only if the medullary canal has been reamed or if another reamer guide has been used. Otherwise follow directly to the step [6].



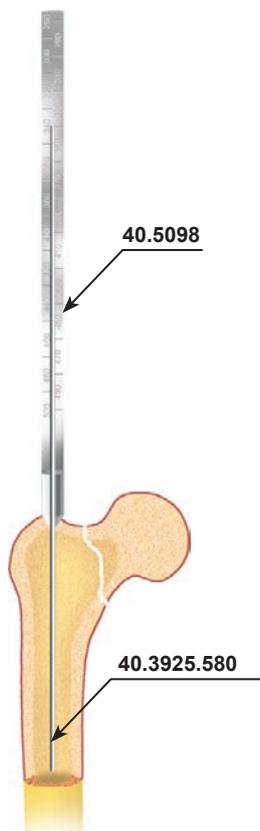
- 4** Insert the Teflon Pipe Guide [40.1348] onto the flexible reamer guide until it reaches the end of medullary canal in distal femur.

Remove the Flexible Reamer Guide.



- 5** Mount the Handle Guide Rod [40.1351] on the Guide Rod 3.0/580 [40.3925] and advance into the Teflon Pipe Guide until its tip reaches the distal epiphysis.

Remove the the Handle Guide Rod [40.1351].  
Remove the Teflon Pipe Guide [40.1348].



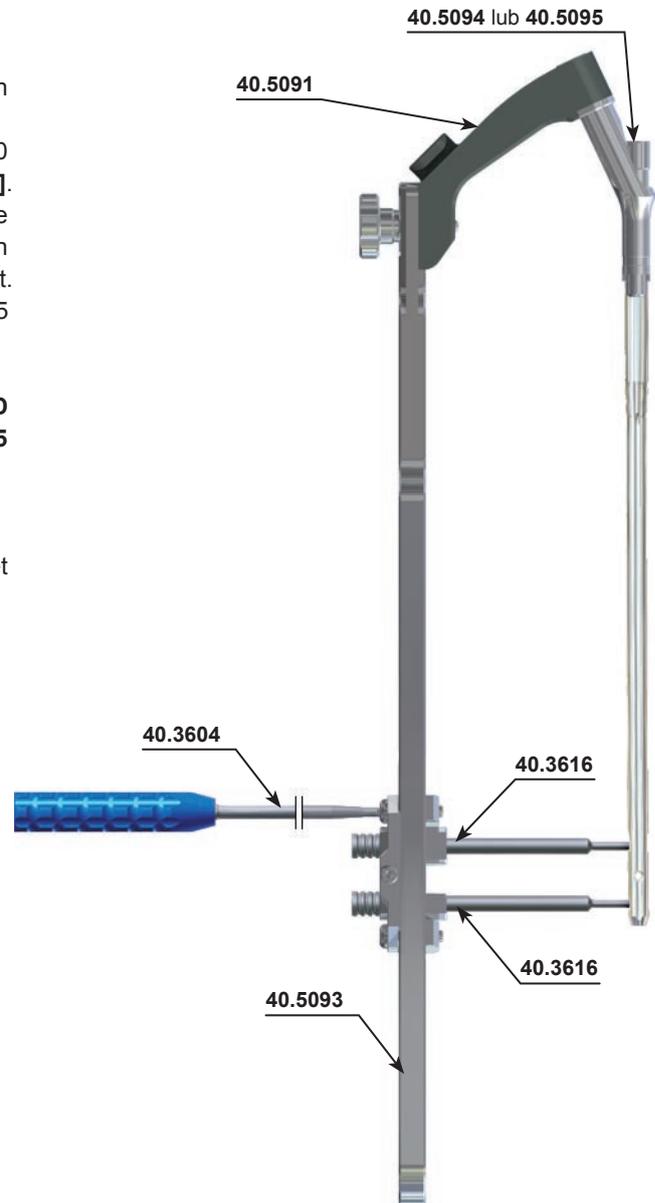
- 6** Insert the Nail Length Measure [40.5098] via the Guide Rod until it rests on the bone. Read the length on the nail measure to assess the length of intramedullary nail. Remove the Nail Length Measure from the Guide Rod. In case of using the solid nail, remove the Guide Rod. Medullary canal is ready for nail insertion.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

- 7** Use the connecting screw:  
 - [40.5095] in case of using reconstruction and compression nail,  
 - [40.5094] in case of using universal nail with the Wrench S10 [40.5526] to fix the intramedullary nail to the Arm Target [40.5091].  
 Fix the Distal Target D [40.5093] to the Arm Target. With pair of the Set Blocks 9/4.5 [40.3616] place the slider of the distal target D in line with distal locking holes of intramedullary nail in its distal part. Secure the slider of the distal target using the Screwdriver S3.5 [40.3604].

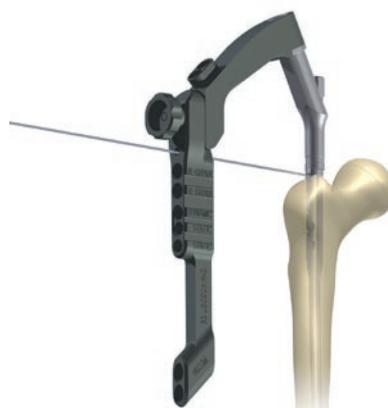
**CHECK:** Properly set and secured slider of the Distal Target D makes possible smoothly hitting the Set Blocks 9/4.5 into the holes of the nail.

Remove the Set Blocks 9/4.5 from the target.  
 Dismount the Distal Target D [40.5093] off the Arm Target [40.5091].



- 8** Mount the Impactor-Extractor [40.5507] on the Arm Target [40.5091] with fixed nail. Insert the nail onto the Guide Rod 3.0/580 [40.3925] in medullary canal. Advance the nail by pushing and maneuvering until it reaches adequate depth.

Remove the Guide Rod 3.0/580 [40.3925].  
 Dismount the Impactor -Extractor [40.5507] from the Arm Target.



- 8a** Mount the Target 135 [40.5097] on the Arm Target [40.5091].

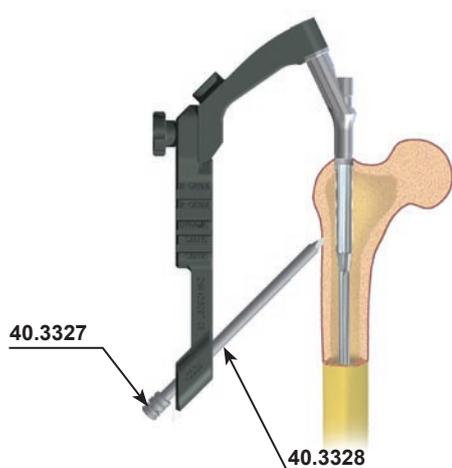
Use Kirschner wire inserted in the hole of the Target 135 [40.5097] (marked "0") to verify correct placement of the nail. The end of the wire shows origin of the nail.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

## IV.2. RECONSTRUCTIVE METHOD

### IV.2.1. Proximal locking of nail

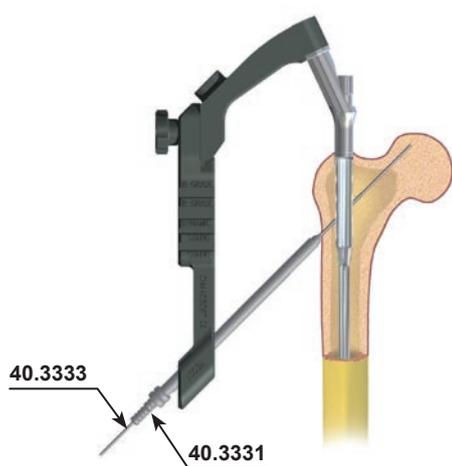
#### IV.2.1.a. **OPTION I:** Locking with reconstruction screws



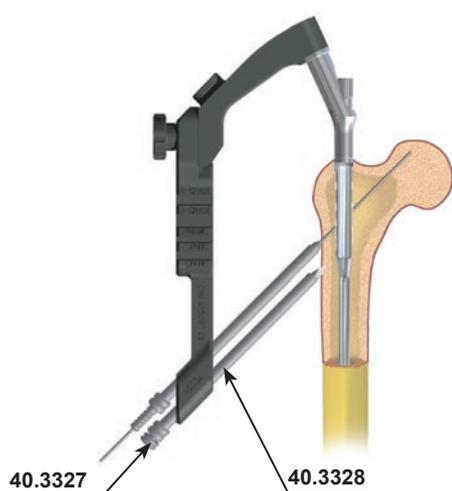
**9** Mount the Target 135 [40.5097] onto the Arm Target [40.5091]. Insert the Protective Guide 11/9 [40.3328] with the Trocar 9 [40.3327] into the first proximal hole of the Target 135 [40.5097]. Mark on the skin the entry point for screws and make adequate incision of the soft tissues.

Advance the trocar until it reaches the cortex bone and mark the entry point for the drill. Simultaneously advance the Protective Guide together with the Trocar until its tip rests on the cortex bone.

Remove the Trocar.  
Leave the Protective Guide in the hole.



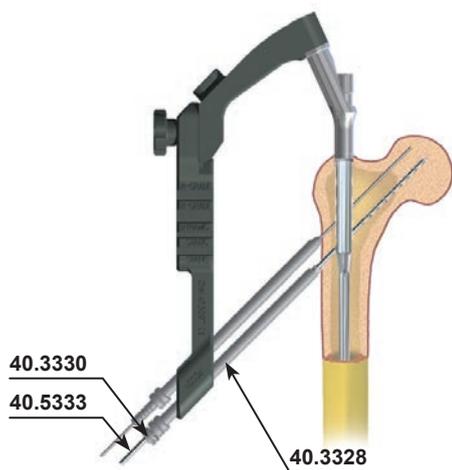
**10** Insert Kirschner Guide [40.3331] into the Protective Guide. Mount Kirschner wire 2.0/380 [40.3333] on the surgical drive and place KW nail into the femoral neck but prevent perforating the femoral head. The above steps should be controlled with X-Ray (image in the drawing plane). Verify the position of KW in the lateral view. The wire should be in the middle of the neck, deviation is acceptable if it allows the screw insertion without damaging the outer cortex of the neck. In case of mis-positioning, repeat the step.



**11** Insert the Protective Guide 11/9 [40.3328] with the Trocar 9 [40.3327] into the second hole in the Target 135 [40.5097]. Advance the Trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

Remove the Trocar.  
Leave the Protective Guide in the hole.

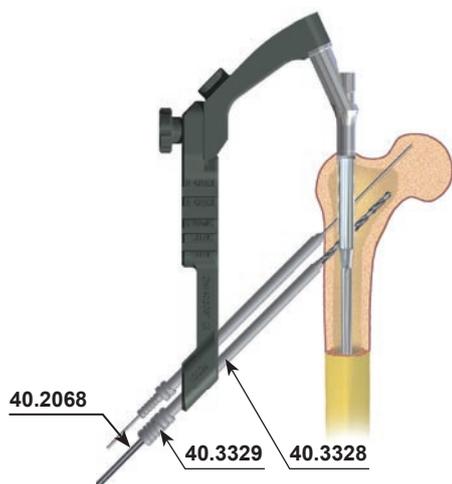
*The above description is not a detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



**12** Insert the Drill Guide 9/4.5 [40.3330] (with two grooves on the handle) into the Protective Guide 11/9 [40.3328] into the second hole of the target. Mount the Drill With Scale 4.5/350 [40.5333] on the surgical drive and advance it through the drill guide.

Drill the hole in the femoral neck (through the proximal hole in the nail) until it reaches adequate depth, but prevent perforating the head. The scale on the Drill shows length of the locking element. Control the drilling process with the X-Ray image intensifier.

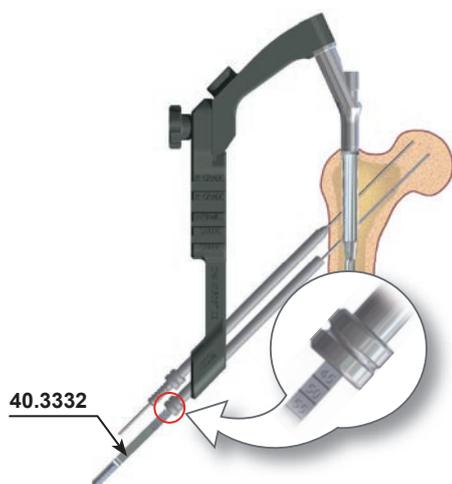
Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.



**13** Insert the Drill Guide 9/6.5 [40.3329] (with three grooves) into the Protective Guide 11/9 [40.3328]. Mount the Drill 6.5/350 [40.2068] on the surgical drive and advance it through the drill guide. Ream the hole in the femoral neck for the depth lesser approx. 30mm than before drilled hole with 4.5 drill (due to the length of the thread of the reconstructive screw).

Control the drilling process with the X-Ray image intensifier.

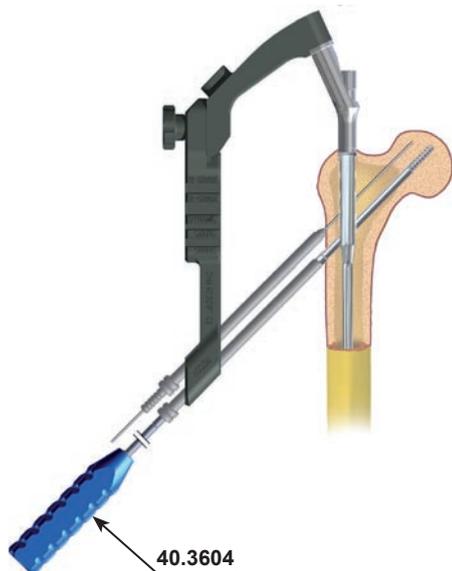
Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.



**14** Insert the Reconstruction Screw Length Measure [40.3332] through the Protective Guide into the drilled hole until it reaches its end. Read the length of the reconstructive screw on the measure. During the measurement the end of the Protective Guide should rest on the cortex bone.

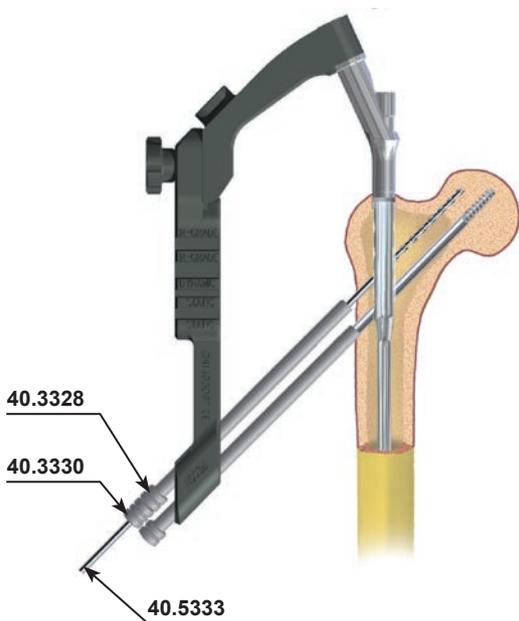
Remove the Screw Length Measure.  
Leave the Protective Guide in the hole of target

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



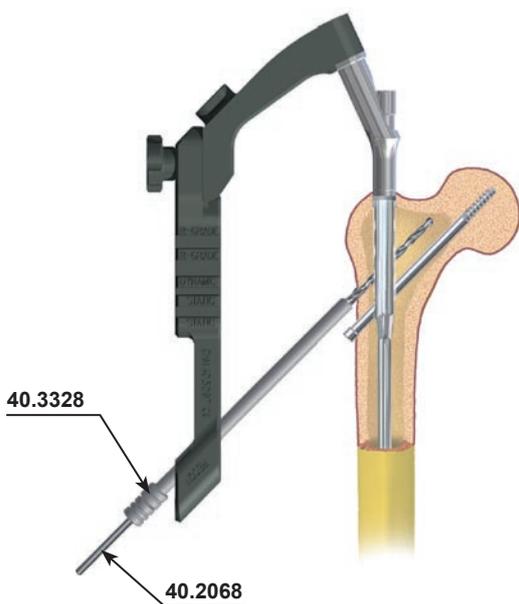
**15** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected reconstructive screw. Then advance both into the Protective Guide. Insert the reconstructive screw in the prepared hole until the head of the screw reaches the cortex bone (the groove on the screwdriver shaft matches the edge of protective guide).

Remove the Screwdriver.



**16** Remove Kirschner wire and Kirschner Guide from the Protective Guide 11/9 [40.3328]. Insert the Drill Guide 9/4.5 [40.3330] (with two grooves on the handle) into the Protective Guide 11/9 [40.3328] (with one groove) left in hole of the target. Mount the Drill With Scale 4.5/350 [40.5333] on the surgical drive and advance it through the drill guide. Drill the hole in the femoral neck (through the proximal hole in the nail) until it reaches adequate depth, but prevent perforating the head. The scale on the drill shows the length of the locking element. Control the drilling process with the X-Ray image intensifier.

Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.

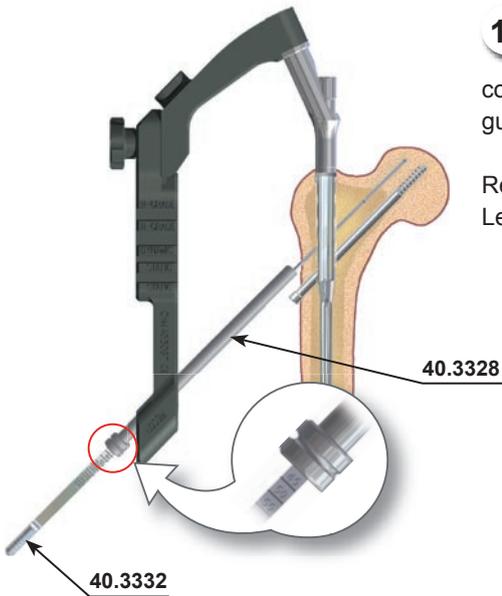


**17** Insert the Drill Guide 9/6.5 [40.3329] (with three grooves) into the Protective Guide. Mount the Drill 6.5/350 [40.2068] on the surgical drive and advance it through the drill guide. Ream the hole in the femoral neck for the lesser depth approx 30mm than before drilled hole with 4.5 drill (due to the length of the thread on the reconstructive screw).

Control the drilling process with the X-Ray image intensifier.

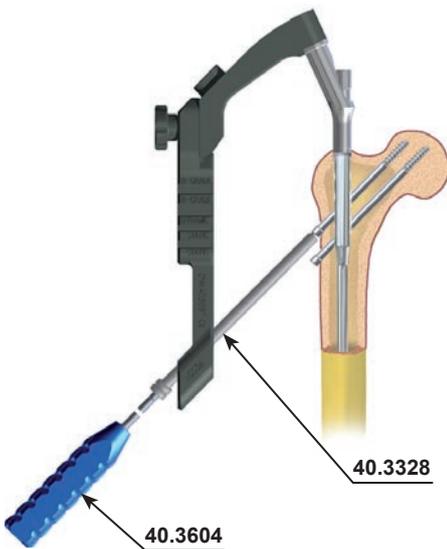
Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



**18** Insert the Reconstruction Screw Length Measure [40.3332] through the Protective Guide into the drilled hole until it reaches its end. Read the length of the reconstructive screw on the measure. During the measurement the end of the protective guide should rest on the cortex bone.

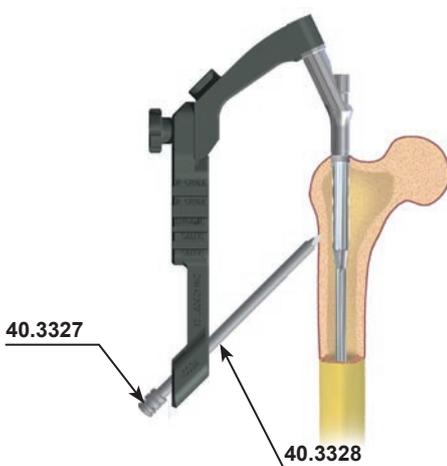
Remove the Screw Length Gauge.  
Leave the Protective Guide in the hole of target



**19** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected reconstructive screw. Then advance both into the Protective Guide. Insert the reconstructive 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 protective guide).

Remove the Screwdriver S3.5 and Protective Guide.

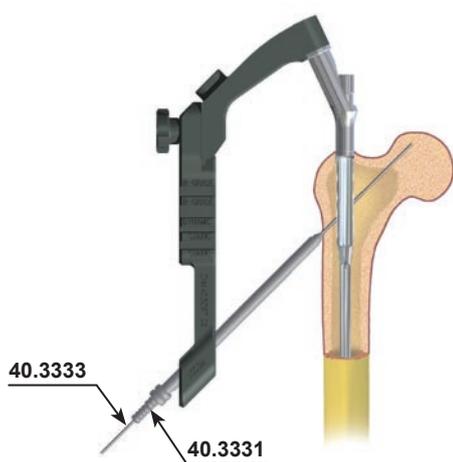
**IV.2.1.b. OPTION II: Locking with cannulated reconstructive screws**



**20** Insert the Protective Guide 11/9 [40.3328] with the Trocar 9 [40.3327] into the first proximal hole in the Target 135 [40.5097]. Mark the entry point for the trocar and make the adequate incision of the soft tissues. Advance the Trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

Remove the Trocar.  
Leave the Protective Guide in the hole.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

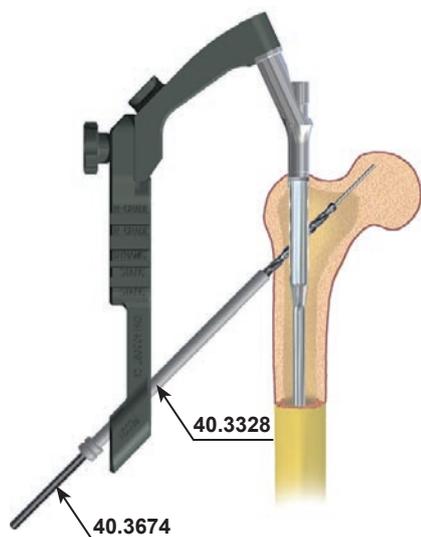
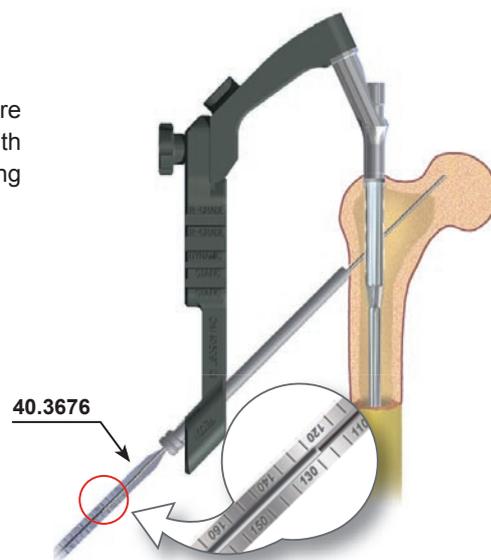


**21** Insert Kirschner Guide [40.3331] and Kirschner Wire 2.0/380 [40.3333] into the Protective Guide 11/9 [40.3328]. Mount KW in the surgical drive and advance into the femoral neck but do not perforate the femoral head. The above step should be controlled with X-Ray (A/P view). Verify the position of KW in the lateral view. KW should be in the middle of the neck, deviation is acceptable if allows screw to be inserted without damaging outer cortex of the neck. Use Kirschner Wire 2.0/380 [40.3333]. In case of mis-positioning the wire, repeat this step.

Remove Kirschner guide.  
Leave Kirschner wire.

**22** Insert the Reconstruction Screw Length Measure [40.3676] onto Kirschner wire drilled into the femoral neck until its tip touches the Protective Guide. Read the length of the Cannulated Reconstructive Screw defined by the end of Kirschner wire. During the measurement the end of the gauge should rest on the cortex bone.

Remove the Screw Length Gauge.  
Leave Kirschner wire.



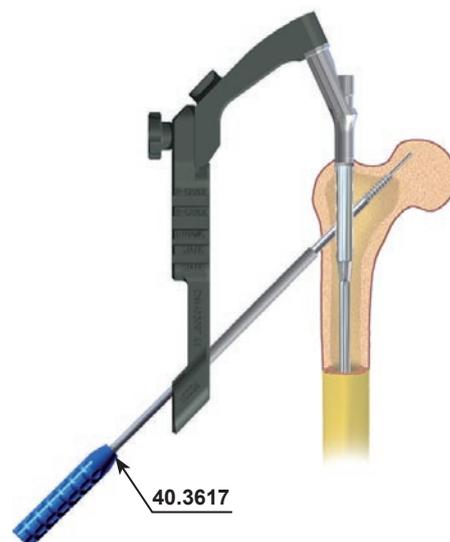
**23** Mount the Cannulated Drill 6.5 [40.3674] on the surgical drive and advance via Kirschner wire mounted in the femoral neck. Drill the hole through the first cortex (up to the nail placed in medullary canal).

Remove the Cannulated Drill.  
Leave Kirschner Wire.

**24** Insert the selected cannulated reconstructive screw onto Kirschner wire. Advance the Cannulated Screwdriver [40.3675] onto Kirschner wire going through the proximal hole of the nail and advance the cannulated reconstructive screw until its head reaches cortex bone.

Remove the Screwdriver and Kirschner Wire.

**NOTE!** To insert second reconstructive screw into the second hole in target, repeat steps [21] to [24].



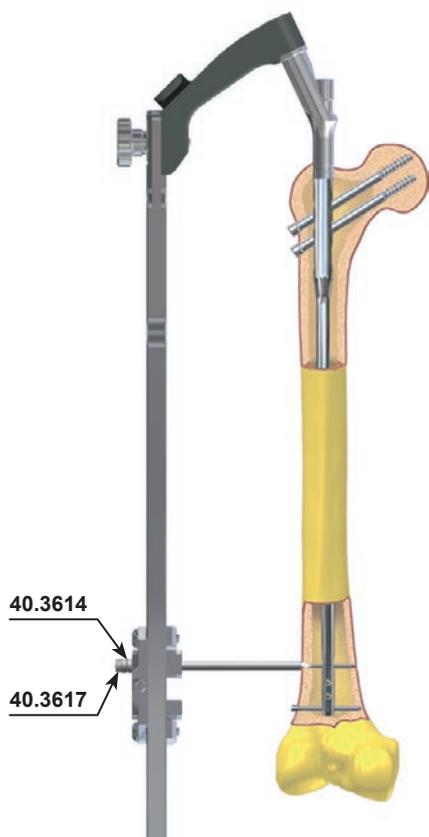
Correctness of femur neck fixation should be verified by taking X-Ray in two projections. Small overall dimensions of the Target B which is additionally deviation at antetorsion angle allows for taking X-Ray in lateral position (C-arm is then positioned at small angle in relation to target position). Nail at radiological image with its locking elements can be helpful at confirming the correctness of locking.



#### IV.2.2. Distal locking of the nail

Before continuing steps connected with distal locking of the nail do the following:

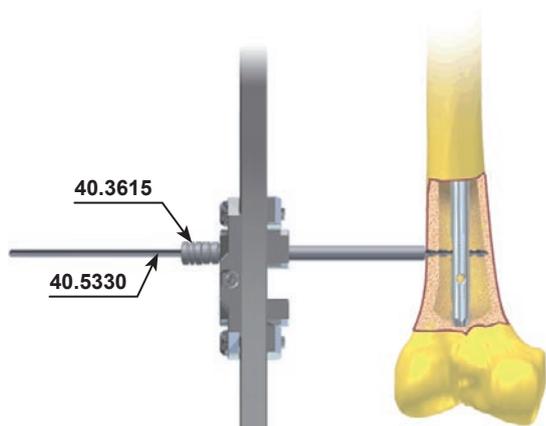
1. Mount the Distal Target D [40.5093] on the Arm Target [40.5091] and secure it with a locknut (included in proximal target). If properly installed, the signs >>RIGHT<< or >>LEFT<< on both target should comply.
2. Verify with the X-Ray the position of holes in the nail and in the target slider. The centers of the holes in nail and target have to be in line.



- 25** Insert the Protective Guide 9/6.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the proximal slider hole of distal target. Mark the entry point for the Trocar and make the adequate incision of the soft tissues. Advance the Trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

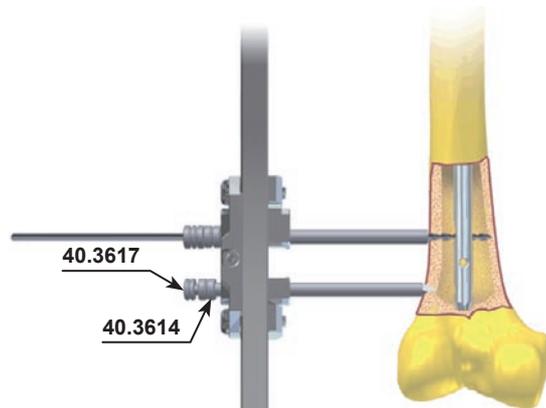
Remove the Trocar.  
Leave the Protective Guide in the hole of the target.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



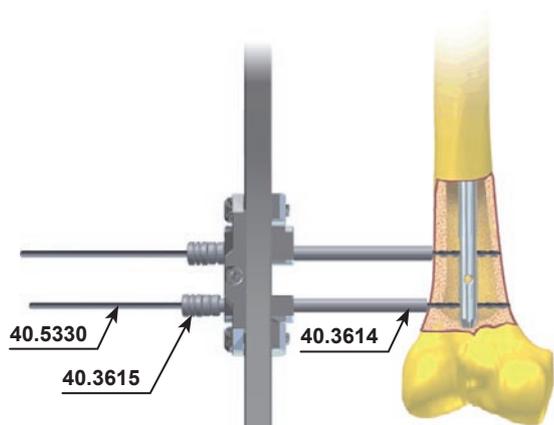
- 26** Insert the Drill Guide 6.5/3.5 [40.3615] (with two grooves) into the Protective Guide left in the slider hole. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the drill guide. Drill the hole in the femoral shaft through both cortex layers and the hole in the nail. The scale on the drill shows length of the locking element.

Disconnect the drive off the drill and leave in system: protective guide-drill guide-drill.



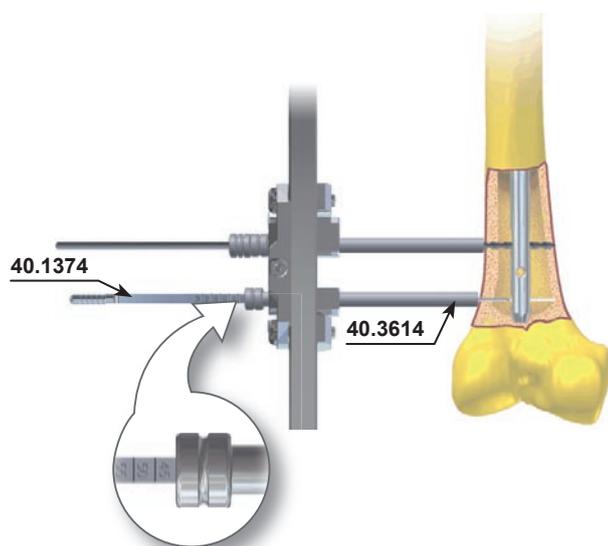
- 27** Insert the Protective Guide [40.3614] (with one groove) with the Trocar 6.5 [40.3617] into the second slider hole of distal target. Advance the Trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

Remove the Trocar.  
Leave the Protective Guide in the hole



- 28** Insert the Drill Guide 6.5/3.5 [40.3615] (with two grooves) into the Protective Guide [40.3614]. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the Drill Guide. Drill the hole in the femoral shaft through both cortex layers and the nail hole. The scale on the drill shows length of the locking element.

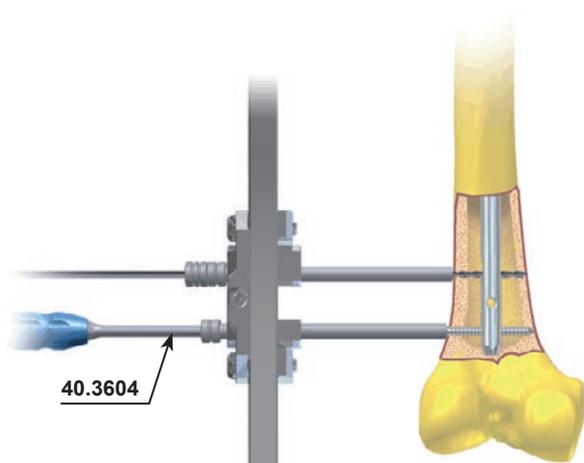
Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the slider hole.



- 29** Insert the Screw Length Measure [40.1374] through the Protective Guide into the drilled hole until its hook reaches the „exit” plain of the bone. Read the length of the locking screw on the measure. During the measurement the tip of Protective Guide should rest on the cortex bone.

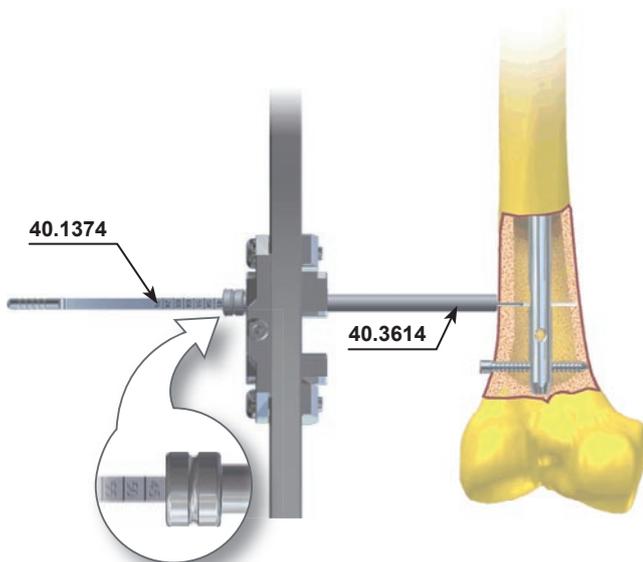
Remove the Screw Length Measure.  
Leave the Protective Guide in place.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



**30** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. 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).

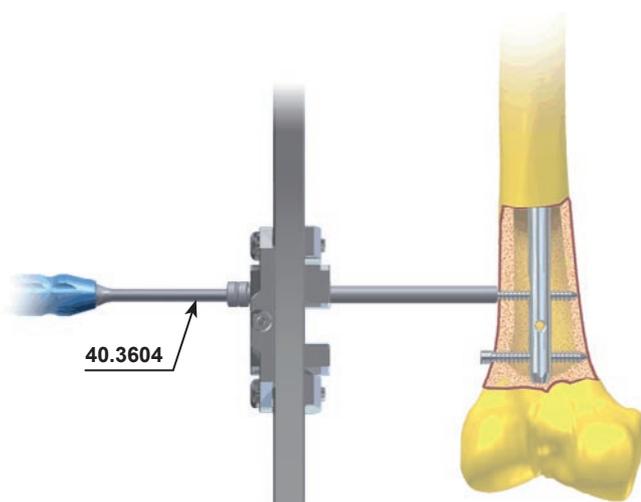
Remove the Screwdriver and Protective Guide.



**31** Remove the Drill and Drill Guide from proximal hole in the slider of the target. Leave the Protective Guide in the hole of the slider. Insert the Screw Length Measure [40.1374] 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 the measure. During the measurement the Protective Guide should rest on the cortex bone.

Remove the Screw Length Measure.

Leave the Protective Guide in slider hole of the target.

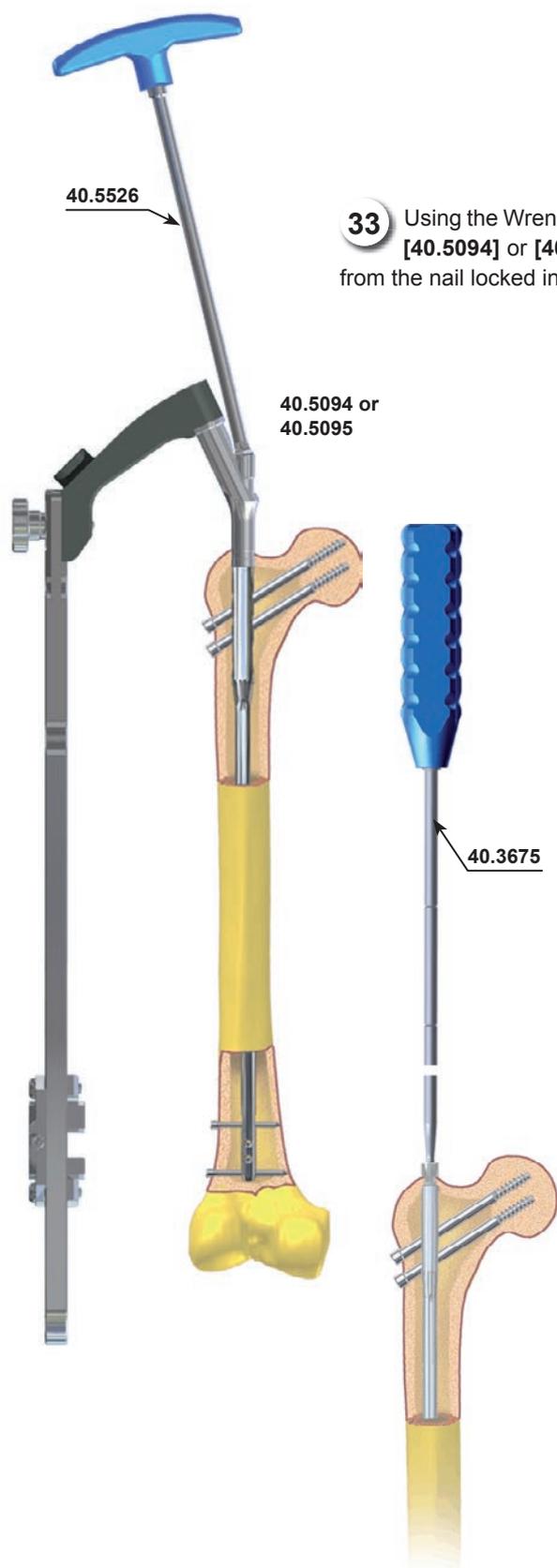


**32** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. Insert the locking screw into the prepared hole until the head of the screw reaches the cortex bone (the groove on the screwdriver shaft matches the edge of the Protective Guide).

Remove the Screwdriver S3.5 and the Protective Guide.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.2.3. Target removal, placing end cap**



**33** Using the Wrench S10 [40.5526] unscrew the Connecting Screw [40.5094] or [40.5095] of the nail shaft and dismount the target from the nail locked in the medullary canal.

- 1.2104.3xx  
universal nail
- 3.2104.3xx
- 1.2104.4xx  
reconstruction nail
- 3.2104.4xxx

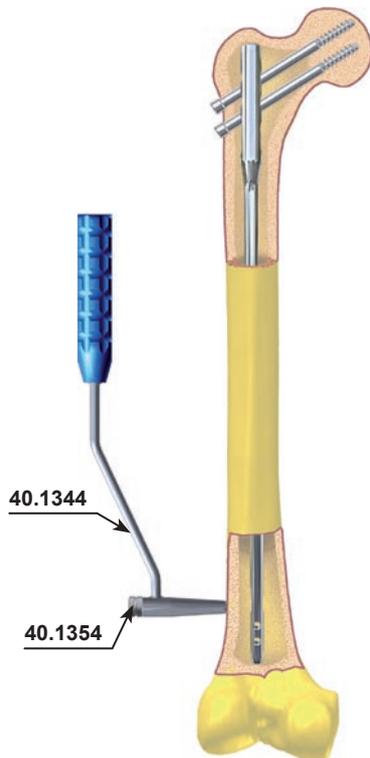
**34** In order to secure the inner thread of the nail from bone ingrowth, using the Cannulated Screwdriver S5.0/2.2 [40.3675] insert:

- the End Cap [1.2104.3xx] or [3.2104.3xx] in case of using universal nail
- the End Cap [1.2104.4xx] or [3.2104.4xx] in case of using reconstructive nail.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

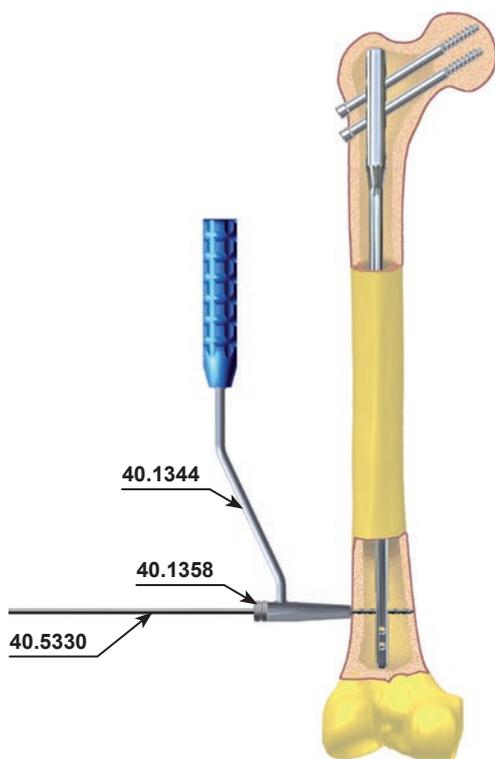
**IV.2.4. Distal locking of the nail “freehand technique”**

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



**35** Using X-Ray place the Target D [40.1344] in the line with the nail hole. The centers of the holes in the target and nail have to match. The teeth of the target D have to be merged in the cortex. Insert the Short Trocar 7 [40.1354] into the hole in target, then advance until it reaches cortex and mark the entry point for the drill.

Remove the Trocar.  
Leave the Target D.



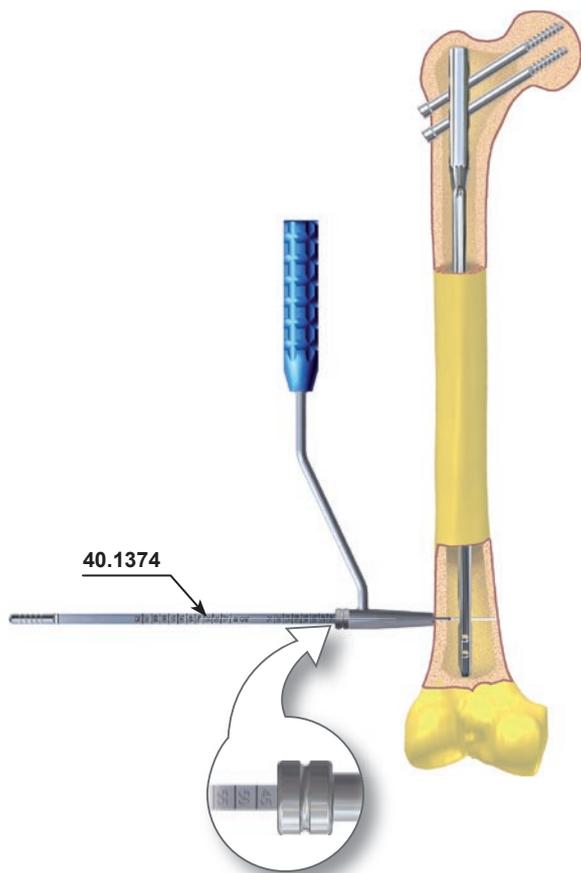
**36** Insert the Drill Guide Short 7/3.5 [40.1358] into the target hole. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the drill guide. Drill the hole in the femoral shaft through both cortex layers and the nail hole. The scale on the drill shows length of the locking element.

Remove the Drill and Drill Guide.  
Leave the Target.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

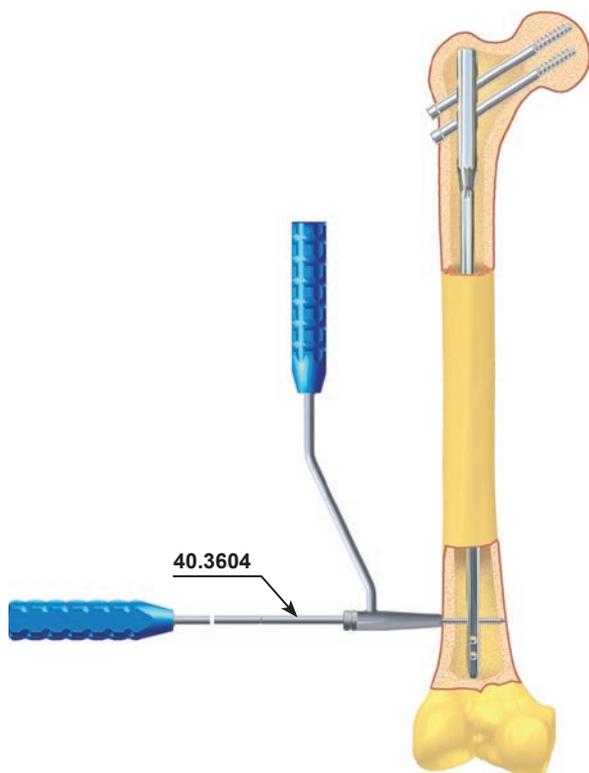
**37** Insert the Screw Length Measure [40.1374] through the Protective Guide into the drilled hole until its hook reaches the „exit” plain of the hole. Read the length of the locking screw on the scale D.

Remove the Screw Length Measure.  
Leave the Target.



**38** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into hole of the Target. Insert the locking screw until its head reaches the cortex bone.

Remove the Screwdriver S3.5 and the Target.

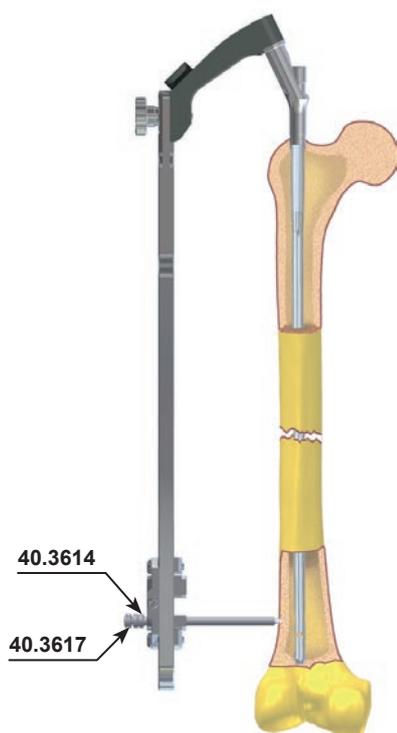


**IV.3. DYNAMIC AND COMPRESSIVE METHODS**

**IV.3.1. Distal locking of the nail**

Before starting the steps connected with distal locking of the nail do the following:

1. Mount the Distal Target D [40.5093] to the Arm Target [40.5091] and secure it with a collar bolt. If properly installed, the signs >>RIGHT<< or >>LEFT<< on both target should comply.
2. Verify using X-Ray the position of nail holes and in distal target slider. The centers of the holes in nail and in distal target slider have to be in line.

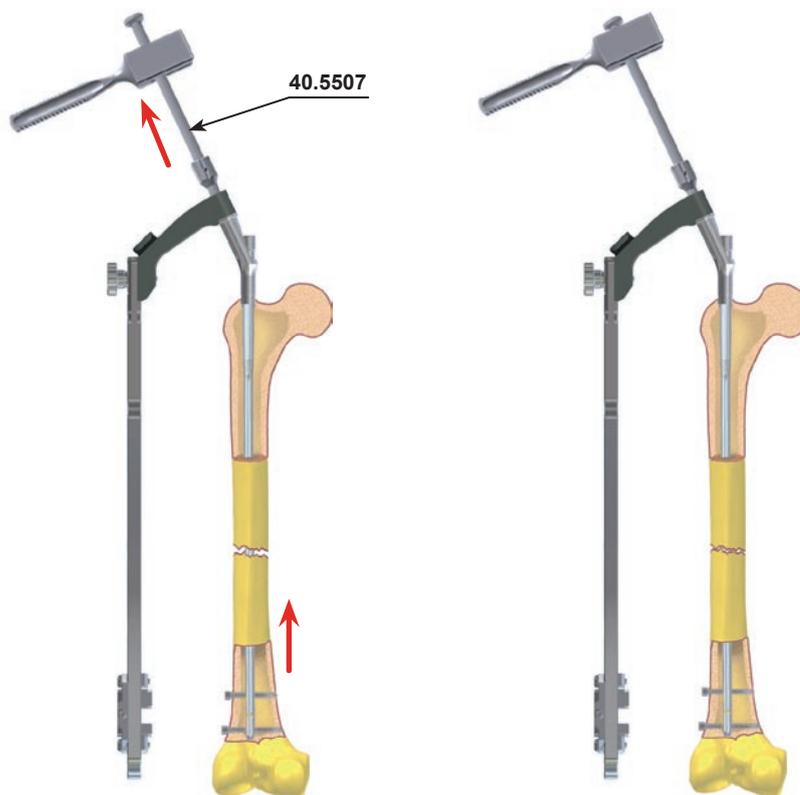


**39** Insert the Protective Guide [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the proximal hole in the distal target slider. Mark the entry point for the locking screw on the skin and make adequate incision through the soft tissues. Advance the Trocar until it reaches cortex and mark the drill entry. Advance Protective Guide together with the Trocar until it touches the cortex bone.

Remove the Trocar.  
Leave the Protective Guide in the hole of target.

**NOTE!** For the rest of the procedure follow the steps [26] to [32].

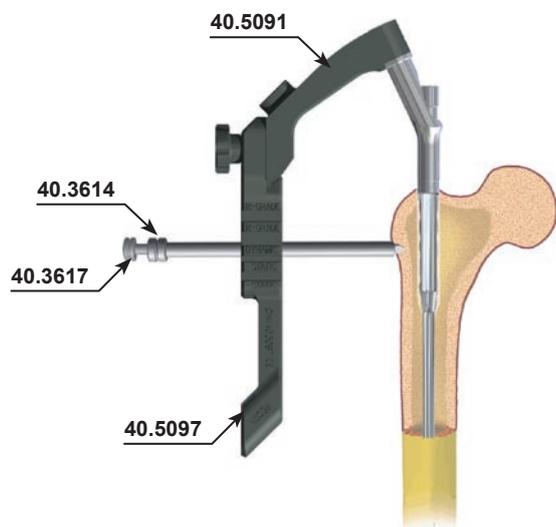
**40** It is possible to make reduction of fracture after locking the nail in distal part by slightly knocking the nail, and then locking the nail in proximal part.



*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

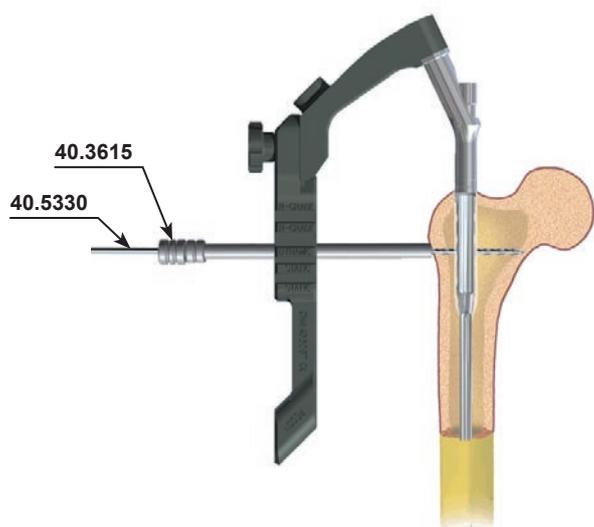
## IV.3.2. Proximal locking of the nail

**Important note!** In compressive and dynamic methods insertion shall be done into the hole of the Target 135 [40.5097] marked >>DYNAMIC<<



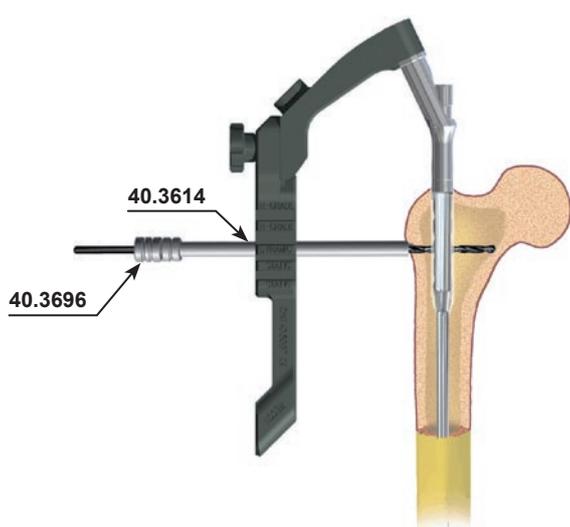
- 41** Mount the Target 135 [40.5097] on the Arm Target [40.5091]. Insert the Protective Guide 9/4.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the proximal hole in the Target 135 [40.5097]. Mark on the skin the entry point for the locking screw and make adequate incision through soft tissues 1.5cm in length. Advance the trocar until it reaches cortex and mark the drill entry. Advance the Protective Guide together with the Trocar until it touches the cortex.

Remove the Trocar.  
Leave the Protective Guide in the hole of target.



- 42** Insert the Drill Guide 6.5/3.5 [40.3615] (with two grooves) into the protective guide. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the Drill Guide. Drill the hole in the femur through both cortex layers and the hole in the nail. The scale on the drill shows length of the locking element.

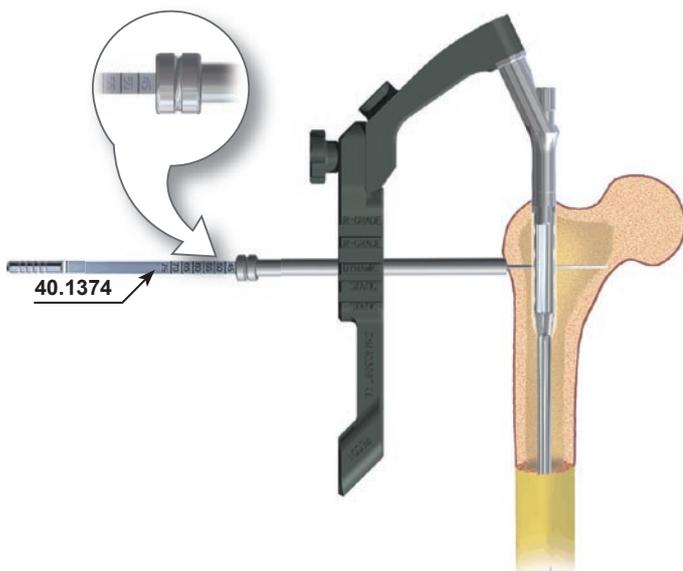
Remove the Drill and Drill Guide.  
Leave the Protective Guide in the hole of target.



- 43** Insert the Drill Guide 6.5/4.5 [40.3696] into the Protective Guide 9/4.5 [40.3614]. Mount the Drill 3.5/250 on the surgical drive and advance it through the drill guide. Drill the hole in the femur through first cortex only up to the nail hole.

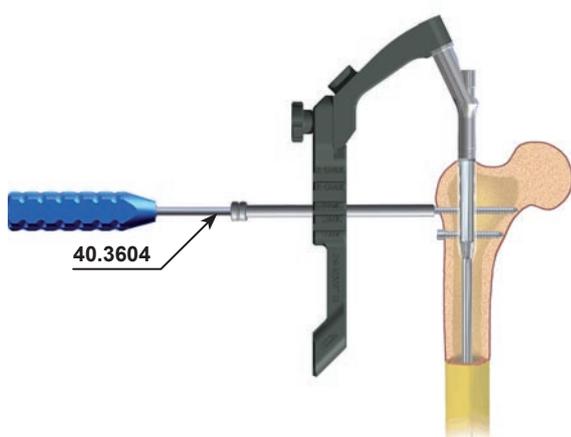
Remove the Drill and Drill Guide.  
Leave the Protective Guide in the hole of target.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



**44** Insert the Screw Length Measure [40.1374] through the protective guide into the drilled hole until its hook reaches the „exit” plain of the hole. Read the length of the locking screw on the Measure scale B-D. During the measurement the end of the Protective Guide should rest on the cortex.

Remove the Screw Length Measure.  
Leave the Protective Guide in the hole of target.



**45** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. 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.



**45a** In order to make the intraoperation compression, using the Screwdriver S3.5 [40.3604] insert the Compression Screw [40.5096] into the Connecting Screw M10x1 L=55 [40.5094] that connects intramedullary nail to the Arm Target. If front of the screw reaches the shaft of locking screw, following screw insertion will cause the compression of bone fragments.

The above steps should be controlled with X-Ray image intensifier to observe the interfragmental slot.

**45b** In order to maintain the bone fragments compression, lock the screw by using hole »STATIC« placed further from »DYNAMIC« hole.

Repeat steps 41-45.

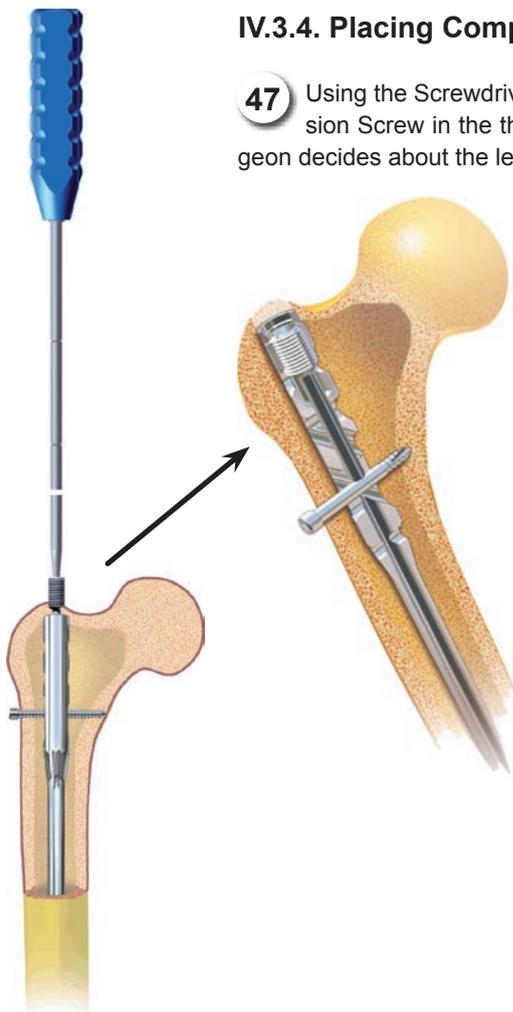
*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.3.3. Target removal**

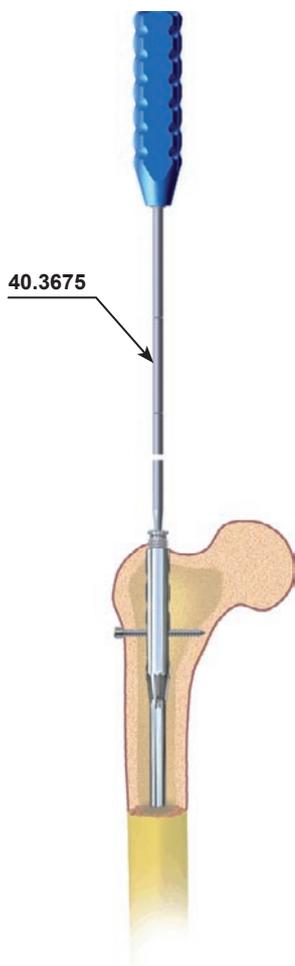


- 46** Using the Wrench S10 [40.5526] unscrew the Connecting Screw [40.5094] or [40.5095] of the nail shaft and dismount the target from the nail locked in the medullary canal.

**IV.3.4. Placing Compression Screw**



- 47** Using the Screwdriver S3.5 [40.3604] insert the Compression Screw in the threaded hole in the nail shaft. The surgeon decides about the level of compression.



**IV.3.5. Placing end cap (dynamic method only)**

- 48** In order to secure the inner thread of the nail from bone ingrowth, using the Cannulated Screwdriver S5.0/2.2 [40.3675] insert :
- the End Cap [1.2104.3xx] or [3.2104.3xx] in case of using universal nail;
  - the End Cap [1.2104.4xx] or [3.2104.3xx] in case of using compression nail.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.4. STATIC METHOD**

**IV.4.1. Distal locking of the nail**

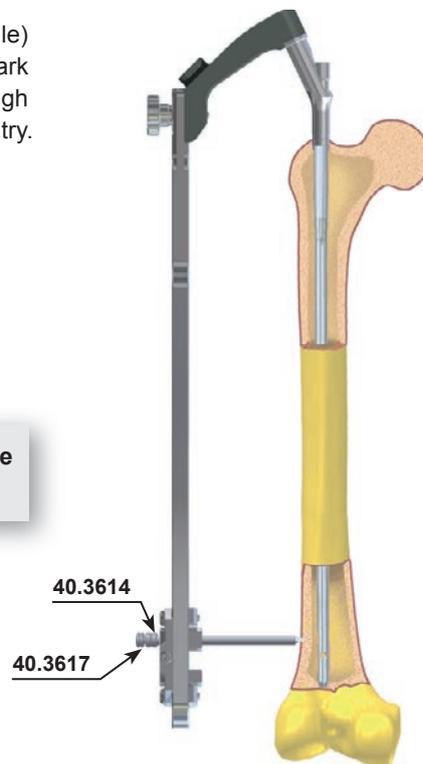
Before starting with steps connected with distal locking of the nail do the following:

1. Mount the Distal Target D [40.5093] on the Arm Target [40.5091] and secure it with a collar bolt (included in proximal target). If properly installed, the signs >>RIGHT<< or >>LEFT<< on both target should comply.
2. Verify with the X-Ray the position of holes in nail and in target slider. The centers of the holes have to be in line.

**49** Insert the the Protective Guide 9/4.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the hole in the slider of distal target D. Mark the entry point for the locking screw on the skin and make adequate incision through the soft tissues. Advance Trocar until it reaches cortex bone and mark the drill entry. Advance Protective Guide together with the Trocar until it touches the cortex.

Remove the Trocar.  
Leave the Protective Guide in the hole of slider.

**NOTE!** For the rest of the procedure follow the steps [26] to [32] from page 30-31

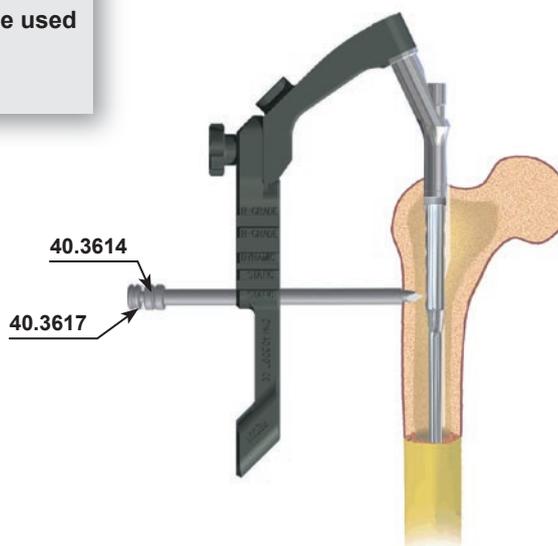


**IV.4.2. Proximal locking of the nail**

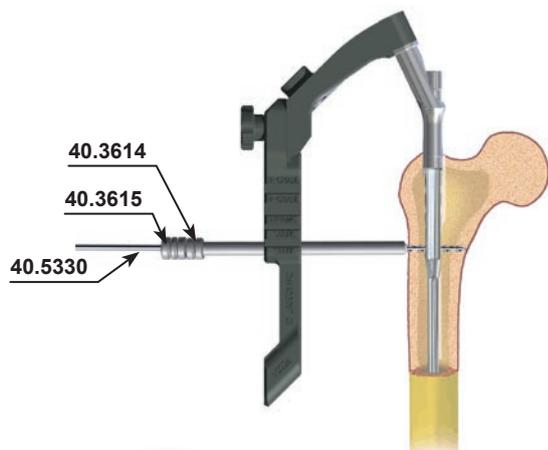
**Important note!** In static method of femoral fixation to lock the intramedullary nail, distal hole in Proximal Target [40.5097] marked >>STATIC<< shall be used. The second hole (proximal) may be used for locking with second locking screw.

**50** Insert the Protective Guide 9/4.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the distal hole in proximal target. Mark the entry point for the locking screw on the skin and make adequate 1.5cm long incision through the soft tissues. Advance the trocar until it reaches cortex and mark the entry point for the drill. Advance Protective Guide together with the Trocar until it touches the cortex.

Remove the Trocar.  
Leave the Protective Guide in the hole of target.

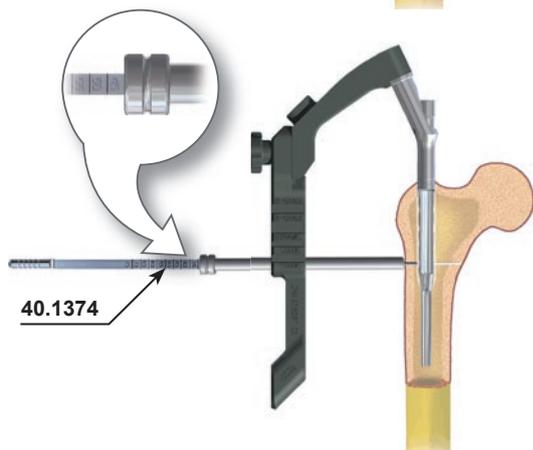


*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



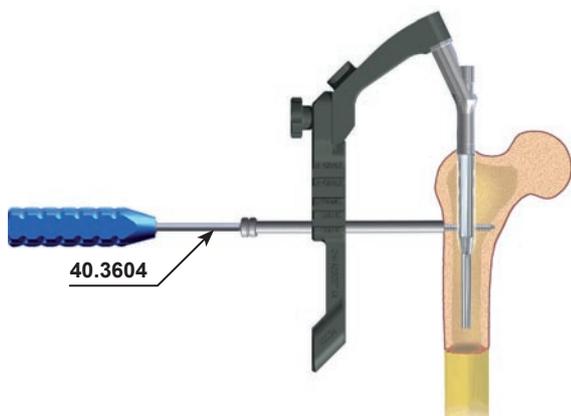
**51** Insert the Drill Guide 6.5/3.5 [40.3615] (with two grooves) into the Protective Guide 9/4.5 [40.3614]. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the Drill Guide. Drill the hole in the femur through both cortex layers and the hole in the nail. The scale on the drill shows length of the locking element.

Remove the Drill and Drill Guide.  
Leave the Protective Guide in the hole of target.



**52** Insert the Screw Length Measure [40.1374] through the Protective Guide 9/4.5 [40.3614] into the drilled hole until its hook reaches the „exit” plain of the hole. Read the length of the locking screw on the gauge scale B-D. During the measurement the end of the Protective Guide should rest on the cortex.

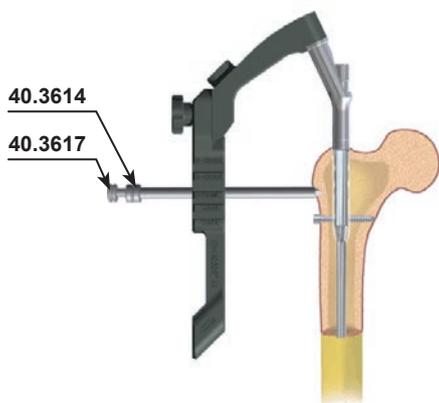
Remove the Screw Length Measure.  
Leave the Protective Guide in the hole of target.



**53** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. Insert the locking screw into the prepared hole until the head of the groove on the screwdriver shaft matches the edge of protective guide).

Remove the Screwdriver and the Protective Guide.

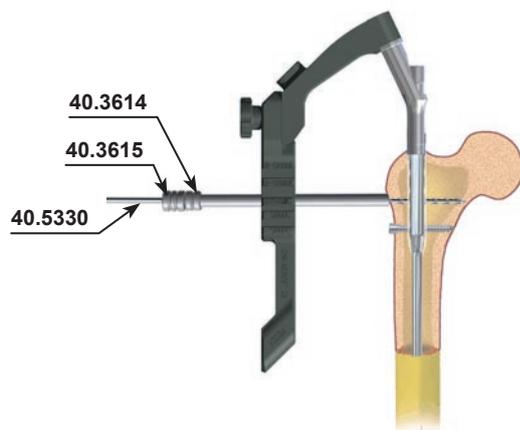
**NOTE!** If surgeon decides to lock the nail in the proximal part with two screws, insertion of second screw should be performed as shown in steps [50] to [53]. Otherwise omit these steps.



**54** Insert the Protective Guide 9/4.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the proximal hole of proximal target. Advance Trocar until it reaches cortex and mark the entry point for the drill. Advance the Protective Guide together with the trocar until it touches the bone.

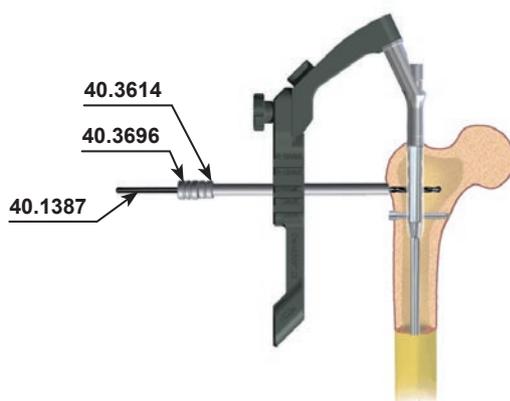
Remove the Trocar.  
Leave the Protective Guide in the hole of the Target.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



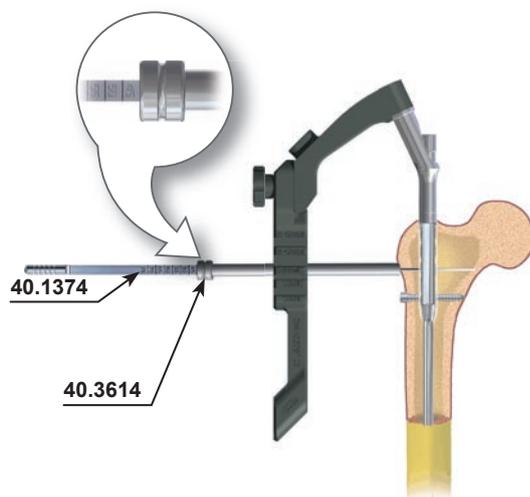
**55** Insert the Drill Guide 6.5/3.5 [40.3615] into the Protective Guide. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the Drill Guide. Drill the hole in the femur through both cortex layers and the nail hole. The scale on the Drill shows length of the locking element.

Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.



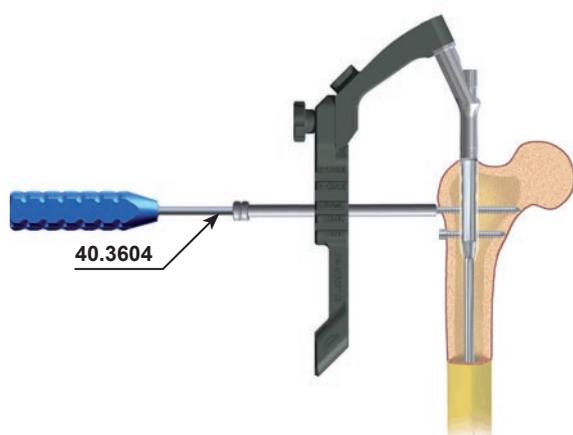
**56** Insert the Drill Guide 6.5/4.5 [40.3696] into the Protective Guide. Mount the Drill 4.5/250 [40.1387] on the surgical drive and advance it through the Drill Guide. Drill the hole in the femur through first cortex up to the hole in the nail.

Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.



**57** Insert the Screw Length Measure [40.1374] through the Protective Guide 9/4.5 [40.3614] into the drilled hole until its hook reaches the „exit” plain of the hole. Read the length of the locking screw on the scale B-D. During the measurement the end of the Protective Guide should rest on the cortex.

Remove the Screw Length Gauge.  
Leave the Protective Guide in the hole of target.



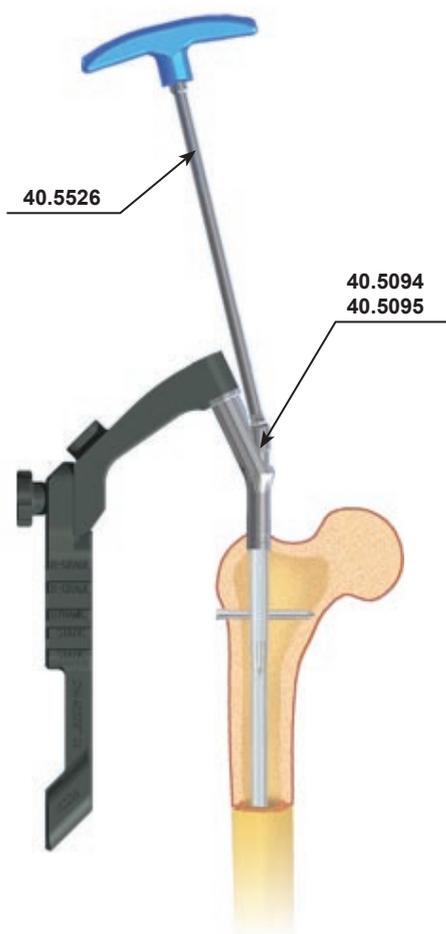
**58** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. Insert the locking screw in the prepared hole until the head of the screw reaches the cortex of the bone (the groove on the screwdriver shaft matches the edge of protective guide).

Remove the Screwdriver and the Protective Guide.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

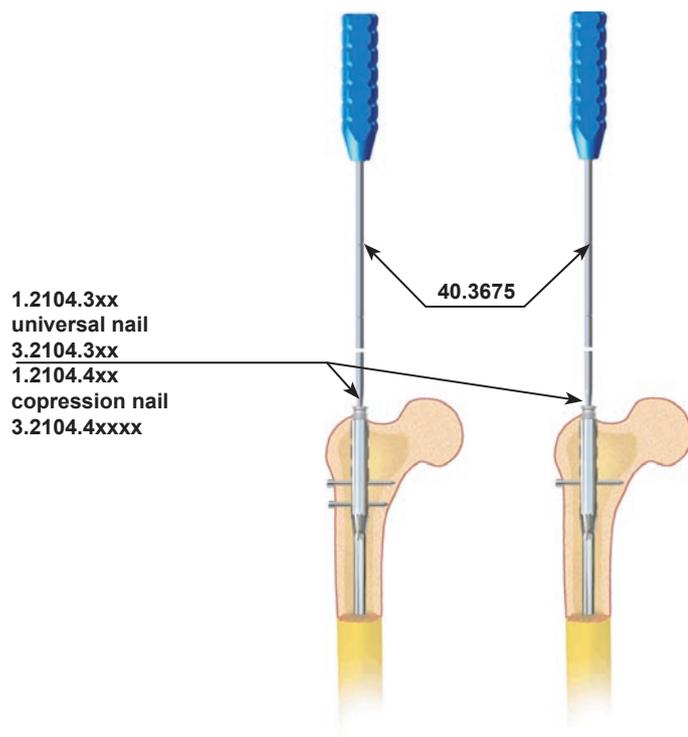
**IV.4.3. Target removal, placing end cap**

**59** Using the Wrench S10 [40.5526] unscrew the Connecting Screw [40.5067] or [40.5069] from the nail shaft and dismount the Target from the nail locked in the medullary canal.



**60** In order to secure the inner thread of the nail from bone ingrowth, using the Cannulated Screwdriver S5.0/2.2 [40.3675] insert:

- the End Cap [1.2104.3xx] or [3.2104.3xx] in case of using the universal nail;
- the End Cap [1.2104.4xx] or [3.2104.4xx] in case of using the compression nail usage.



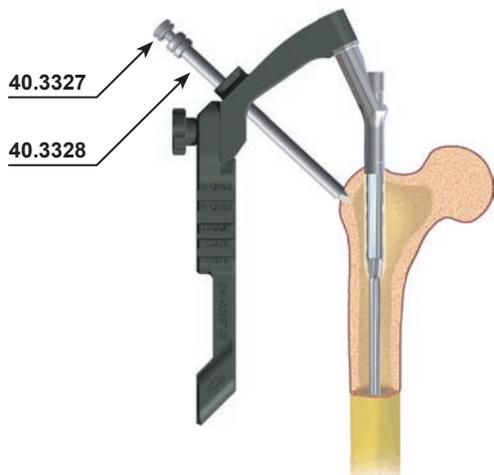
*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.5. STATIC METHOD WITH USE OF RECONSTRUCTION NAIL**

**IV.5.1. Proximal locking of the nail**

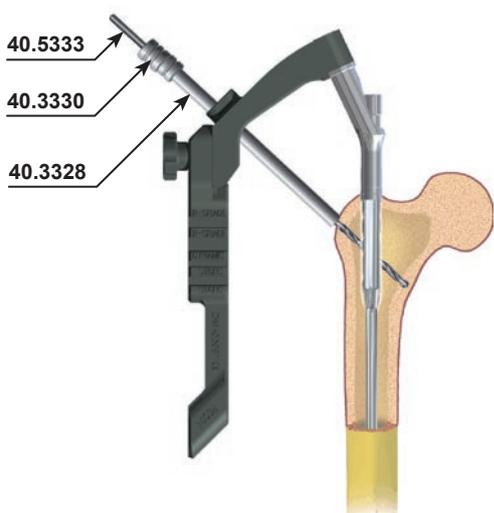
In the static method, the intramedullary reconstruction nails for fixation of femoral fragments may be used:

- right nail (market RIGHT) should be used for fixation of the left femur,
- left nail (market LEFT) should be used for fixation of the right femur.



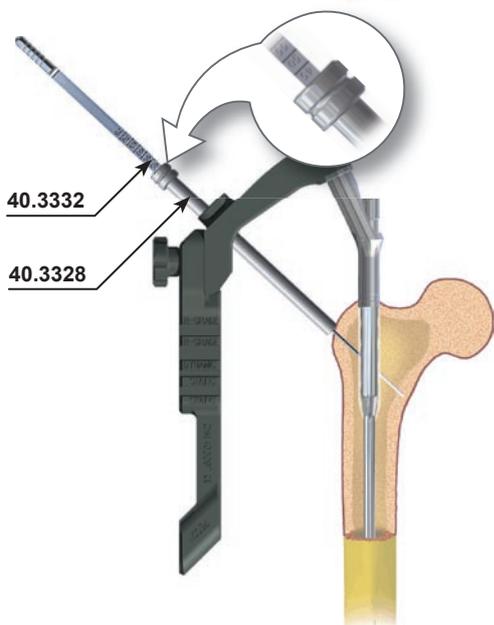
**61** Insert the Protective Guide [40.3328] (with one groove on the handle) with the Trocar Ø9 [40.3327] into the hole in the the Arm Target [40.5091]. Mark the entry point for the locking screw and make an adequate incision of the soft tissues. Advance the Trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

Remove the Trocar.  
Leave the Protective Guide in the hole of target.



**62** Insert the Drill Guide 9/4.5 [40.3330] (with two grooves) into the protective guide. Mount the Drill With Scale 4.5/350 [40.5333] on the surgical drive and advance it through the drill guide. Drill the hole in the femur through both cortex layers and the hole in the nail. The scale on the drill shows length of the locking element

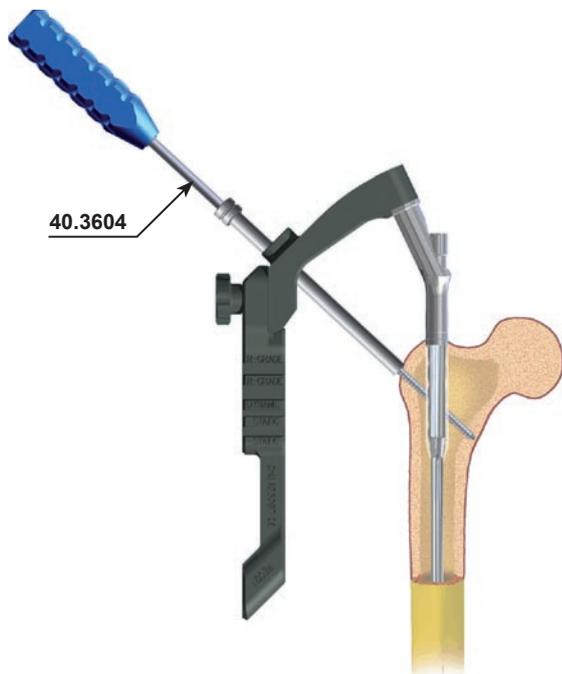
Remove the Drill and the Drill Guide.  
Leave the Protective Guide in the hole of target.



**63** Insert the Reconstruction Screw Length Measure [40.3332] through the Protective Guide into the drilled hole until its hook reaches the „exit” plain of the hole. Read the length of the reconstruction screw on the gauge. 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 target.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



- 64** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. For locking use the screw with 6.5mm diameter and length determined in previous step. Then advance both into the Protective Guide. Insert the reconstructive 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 Protective Guide).

Remove the Screwdriver S3.5 and Protective Guide.

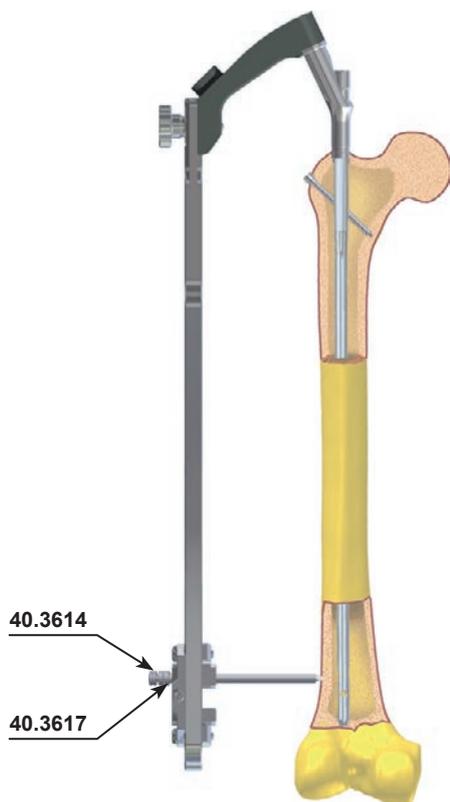
## IV.5.2. Distal locking of the nail

Before distal locking of the nail do the following:

1. Mount distal target [40.3322] again on the arm of the proximal target [40.5061] and secure it with a locknut included in proximal target).

If properly installed, the signs >>RIGHT<< or >>LEFT<< on both target should comply.

2. Verify with the X-Ray image intensifier the position of holes in the nail and in target slider. The centers of the holes have to be in line.



- 65** Insert the Protective Guide 9/4.5 [40.3614] (with one groove on the handle) with the Trocar 6.5 [40.3617] into the hole in the slider of distal target. Mark on the skin the entry point for the locking screw and make adequate incision through the soft tissues. Advance the Trocar until it reaches cortex and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the cortex.

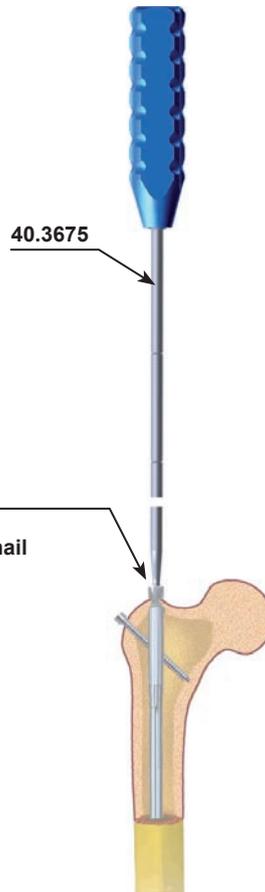
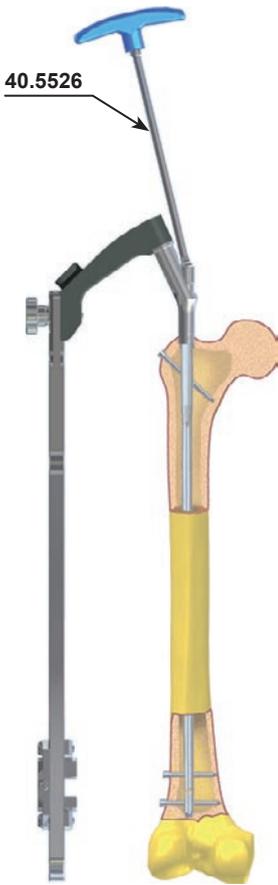
Remove the Trocar.

Leave the Protective Guide in the hole of slider of target.

**NOTE!** For the rest of the procedure follow the steps [26] to [32] from page 30 to 31.

**IV.5.3. Target removal, end cap placing**

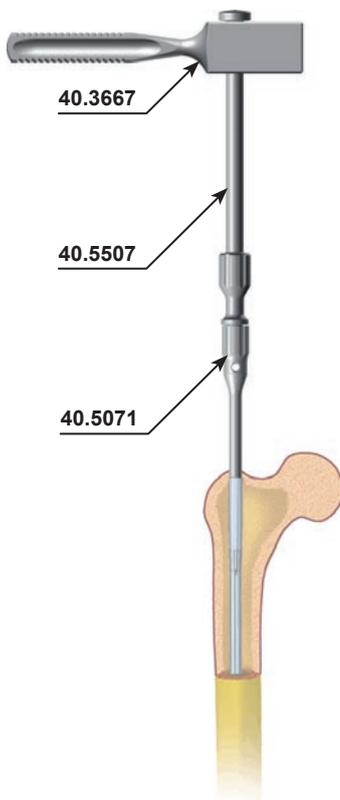
**66** Using the Wrench S10 [40.3326] unscrew the Connecting Screw [40.5094] or [40.5095] of the nail shaft and dismount the target from the nail locked in the medullary canal.



**67** In order to secure the inner thread of the nail from bone ingrowth, using the Cannulated Screwdriver S5.0/2.2 [40.3675] insert:

- the End Cap [1.2104.3xx] or [3.2104.3xx] in case of using universal nail,
- the End Cap [1.2104.4xx] or [1.2104.3xx] in case of using compression nail.

1.2104.3xx  
universal nail  
3.2104.3xx  
1.2104.4xx  
compression nail  
3.2104.4xxx



**IV.6. NAIL EXTRACTION**

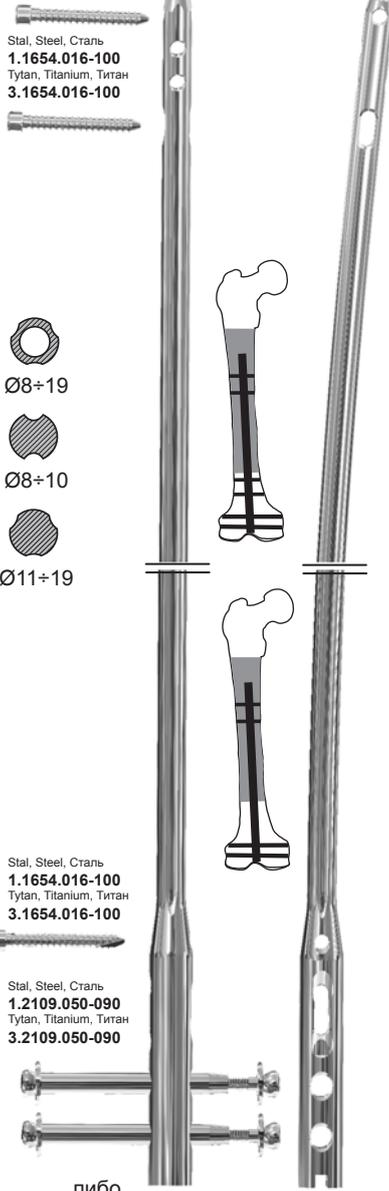
**68** Use the Cannulated Screwdriver S5.0/2.2 [40.3675] to remove the End Cap and Screwdriver S3.5 [40.4604] to remove compression screw from the nail shaft. Insert the Connector [40.5071] into the threaded nail hole. Using the Screwdriver S3.5 [40.3604] unscrew all the locking screws. Attach the Impactor-Extractor [40.5070] to the connector and with help of the Mallet [40.3667] extract the nail from the medullary canal.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

IV.7. SURGICAL TECHNIQUE - REVERSED METHOD /CONDYLAR APPROACH/

IV.7.a. Implants of reversed method

Metoda wsteczna  
reverse method  
ретроградный метод



Stal, Steel, Сталь  
**1.1654.016-100**  
Titan, Titanium, Титан  
**3.1654.016-100**

Ø8+19

Ø8+10

Ø11+19

Stal, Steel, Сталь  
**1.1654.016-100**  
Titan, Titanium, Титан  
**3.1654.016-100**

Stal, Steel, Сталь  
**1.2109.050-090**  
Titan, Titanium, Титан  
**3.2109.050-090**

либо

Stal, Steel, Сталь  
**1.1651.030-110**  
Titan, Titanium, Титан  
**3.1651.030-110**

Stal  
**1.2104.002**  
Titan  
**3.2104.002**

Śruba zaślepiająca M10x1  
End cap M10x1  
Винт слепой M10x1

dostępne  
available  
доступные

Ø [mm]	8+19	8+19
L [mm]	240+600	240+600

L [mm]	Ø	STAL, Steel, Сталь		TYTAN, Titanium, Титан		L [mm]	Ø	STAL, Steel, Сталь		TYTAN, Titanium, Титан	
		lewy, left левый	prawy, right правый	lewy, left левый	prawy, right правый			lewy, left левый	prawy, right правый		
200	9	1.2855.200	1.2854.200	3.2855.200	3.2854.200	200	12	1.2861.200	1.2860.200	3.2861.200	3.2860.200
220		1.2855.220	1.2854.220	3.2855.220	3.2854.220	220		1.2861.220	1.2860.220	3.2861.220	3.2860.220
240		1.2855.240	1.2854.240	3.2855.240	3.2854.240	240		1.2861.240	1.2860.240	3.2861.240	3.2860.240
260		1.2855.260	1.2854.260	3.2855.260	3.2854.260	260		1.2861.260	1.2860.260	3.2861.260	3.2860.260
280		1.2855.280	1.2854.280	3.2855.280	3.2854.280	280		1.2861.280	1.2860.280	3.2861.280	3.2860.280
300		1.2855.300	1.2854.300	3.2855.300	3.2854.300	300		1.2861.300	1.2860.300	3.2861.300	3.2860.300
320		1.2855.320	1.2854.320	3.2855.320	3.2854.320	320		1.2861.320	1.2860.320	3.2861.320	3.2860.320
340		1.2855.340	1.2854.340	3.2855.340	3.2854.340	340		1.2861.340	1.2860.340	3.2861.340	3.2860.340
360		1.2855.360	1.2854.360	3.2855.360	3.2854.360	360		1.2861.360	1.2860.360	3.2861.360	3.2860.360
380		1.2855.380	1.2854.380	3.2855.380	3.2854.380	380		1.2861.380	1.2860.380	3.2861.380	3.2860.380
400	1.2855.400	1.2854.400	3.2855.400	3.2854.400	400	1.2861.400	1.2860.400	3.2861.400	3.2860.400		
420	1.2855.420	1.2854.420	3.2855.420	3.2854.420	420	1.2861.420	1.2860.420	3.2861.420	3.2860.420		
440	1.2855.440	1.2854.440	3.2855.440	3.2854.440	440	1.2861.440	1.2860.440	3.2861.440	3.2860.440		
460	1.2855.460	1.2854.460	3.2855.460	3.2854.460	460	1.2861.460	1.2860.460	3.2861.460	3.2860.460		
480	1.2855.480	1.2854.480	3.2855.480	3.2854.480	480	1.2861.480	1.2860.480	3.2861.480	3.2860.480		
200	10	1.2857.200	1.2856.200	3.2857.200	3.2856.200	200	13	1.2863.200	1.2862.200	3.2863.200	3.2862.200
220		1.2857.220	1.2856.220	3.2857.220	3.2856.220	220		1.2863.220	1.2862.220	3.2863.220	3.2862.220
240		1.2857.240	1.2856.240	3.2857.240	3.2856.240	240		1.2863.240	1.2862.240	3.2863.240	3.2862.240
260		1.2857.260	1.2856.260	3.2857.260	3.2856.260	260		1.2863.260	1.2862.260	3.2863.260	3.2862.260
280		1.2857.280	1.2856.280	3.2857.280	3.2856.280	280		1.2863.280	1.2862.280	3.2863.280	3.2862.280
300		1.2857.300	1.2856.300	3.2857.300	3.2856.300	300		1.2863.300	1.2862.300	3.2863.300	3.2862.300
320		1.2857.320	1.2856.320	3.2857.320	3.2856.320	320		1.2863.320	1.2862.320	3.2863.320	3.2862.320
340		1.2857.340	1.2856.340	3.2857.340	3.2856.340	340		1.2863.340	1.2862.340	3.2863.340	3.2862.340
360		1.2857.360	1.2856.360	3.2857.360	3.2856.360	360		1.2863.360	1.2862.360	3.2863.360	3.2862.360
380		1.2857.380	1.2856.380	3.2857.380	3.2856.380	380		1.2863.380	1.2862.380	3.2863.380	3.2862.380
400	1.2857.400	1.2856.400	3.2857.400	3.2856.400	400	1.2863.400	1.2862.400	3.2863.400	3.2862.400		
420	1.2857.420	1.2856.420	3.2857.420	3.2856.420	420	1.2863.420	1.2862.420	3.2863.420	3.2862.420		
440	1.2857.440	1.2856.440	3.2857.440	3.2856.440	440	1.2863.440	1.2862.440	3.2863.440	3.2862.440		
460	1.2857.460	1.2856.460	3.2857.460	3.2856.460	460	1.2863.460	1.2862.460	3.2863.460	3.2862.460		
480	1.2857.480	1.2856.480	3.2857.480	3.2856.480	480	1.2863.480	1.2862.480	3.2863.480	3.2862.480		
200	11	1.2859.200	1.2858.200	3.2859.200	3.2858.200	200	14	1.2865.200	1.2864.200	3.2865.200	3.2864.200
220		1.2859.220	1.2858.220	3.2859.220	3.2858.220	220		1.2865.220	1.2864.220	3.2865.220	3.2864.220
240		1.2859.240	1.2858.240	3.2859.240	3.2858.240	240		1.2865.240	1.2864.240	3.2865.240	3.2864.240
260		1.2859.260	1.2858.260	3.2859.260	3.2858.260	260		1.2865.260	1.2864.260	3.2865.260	3.2864.260
280		1.2859.280	1.2858.280	3.2859.280	3.2858.280	280		1.2865.280	1.2864.280	3.2865.280	3.2864.280
300		1.2859.300	1.2858.300	3.2859.300	3.2858.300	300		1.2865.300	1.2864.300	3.2865.300	3.2864.300
320		1.2859.320	1.2858.320	3.2859.320	3.2858.320	320		1.2865.320	1.2864.320	3.2865.320	3.2864.320
340		1.2859.340	1.2858.340	3.2859.340	3.2858.340	340		1.2865.340	1.2864.340	3.2865.340	3.2864.340
360		1.2859.360	1.2858.360	3.2859.360	3.2858.360	360		1.2865.360	1.2864.360	3.2865.360	3.2864.360
380		1.2859.380	1.2858.380	3.2859.380	3.2858.380	380		1.2865.380	1.2864.380	3.2865.380	3.2864.380
400	1.2859.400	1.2858.400	3.2859.400	3.2858.400	400	1.2865.400	1.2864.400	3.2865.400	3.2864.400		
420	1.2859.420	1.2858.420	3.2859.420	3.2858.420	420	1.2865.420	1.2864.420	3.2865.420	3.2864.420		
440	1.2859.440	1.2858.440	3.2859.440	3.2858.440	440	1.2865.440	1.2864.440	3.2865.440	3.2864.440		
460	1.2859.460	1.2858.460	3.2859.460	3.2858.460	460	1.2865.460	1.2864.460	3.2865.460	3.2864.460		
480	1.2859.480	1.2858.480	3.2859.480	3.2858.480	480	1.2865.480	1.2864.480	3.2865.480	3.2864.480		

L [mm]	Ø	STAL, Steel, Сталь		TYTAN, Titanium, Титан		L [mm]	Ø	STAL, Steel, Сталь		TYTAN, Titanium, Титан	
		lewy, left левый	prawy, right правый	lewy, left левый	prawy, right правый			lewy, left левый	prawy, right правый		
200	8	1.2877.200	1.2876.200	3.2877.200	3.2876.200	200	11	1.2883.200	1.2882.200	3.2883.200	3.2882.200
220		1.2877.220	1.2876.220	3.2877.220	3.2876.220	220		1.2883.220	1.2882.220	3.2883.220	3.2882.220
240		1.2877.240	1.2876.240	3.2877.240	3.2876.240	240		1.2883.240	1.2882.240	3.2883.240	3.2882.240
260		1.2877.260	1.2876.260	3.2877.260	3.2876.260	260		1.2883.260	1.2882.260	3.2883.260	3.2882.260
280		1.2877.280	1.2876.280	3.2877.280	3.2876.280	280		1.2883.280	1.2882.280	3.2883.280	3.2882.280
300		1.2877.300	1.2876.300	3.2877.300	3.2876.300	300		1.2883.300	1.2882.300	3.2883.300	3.2882.300
320		1.2877.320	1.2876.320	3.2877.320	3.2876.320	320		1.2883.320	1.2882.320	3.2883.320	3.2882.320
340		1.2877.340	1.2876.340	3.2877.340	3.2876.340	340		1.2883.340	1.2882.340	3.2883.340	3.2882.340
360		1.2877.360	1.2876.360	3.2877.360	3.2876.360	360		1.2883.360	1.2882.360	3.2883.360	3.2882.360
380		1.2877.380	1.2876.380	3.2877.380	3.2876.380	380		1.2883.380	1.2882.380	3.2883.380	3.2882.380
400	1.2877.400	1.2876.400	3.2877.400	3.2876.400	400	1.2883.400	1.2882.400	3.2883.400	3.2882.400		
420	1.2877.420	1.2876.420	3.2877.420	3.2876.420	420	1.2883.420	1.2882.420	3.2883.420	3.2882.420		
440	1.2877.440	1.2876.440	3.2877.440	3.2876.440	440	1.2883.440	1.2882.440	3.2883.440	3.2882.440		
460	1.2877.460	1.2876.460	3.2877.460	3.2876.460	460	1.2883.460	1.2882.460	3.2883.460	3.2882.460		
480	1.2877.480	1.2876.480	3.2877.480	3.2876.480	480	1.2883.480	1.2882.480	3.2883.480	3.2882.480		
200	9	1.2879.200	1.2878.200	3.2879.200	3.2878.200	200	12	1.2885.200	1.2884.200	3.2885.200	3.2884.200
220		1.2879.220	1.2878.220	3.2879.220	3.2878.220	220		1.2885.220	1.2884.220	3.2885.220	3.2884.220
240		1.2879.240	1.2878.240	3.2879.240	3.2878.240	240		1.2885.240	1.2884.240	3.2885.240	3.2884.240
260		1.2879.260	1.2878.260	3.2879.260	3.2878.260	260		1.2885.260	1.2884.260	3.2885.260	3.2884.260
280		1.2879.280	1.2878.280	3.2879.280	3.2878.280	280		1.2885.280	1.2884.280	3.2885.280	3.2884.280
300		1.2879.300	1.2878.300	3.2879.300	3.2878.300	300		1.2885.300	1.2884.300	3.2885.300	3.2884.300
320		1.2879.320	1.2878.320	3.2879.320	3.2878.320	320		1.2885.320	1.2884.320	3.2885.320	3.2884.320
340		1.2879.340	1.2878.340	3.2879.340	3.2878.340	340		1.2885.340	1.2884.340	3.2885.340	3.2884.340
360		1.2879.360	1.2878.360	3.2879.360	3.2878.360	360		1.2885.360	1.2884.360	3.2885.360	3.2884.360
380		1.2879.380	1.2878.380	3.2879.380	3.2878.380	380		1.2885.380	1.2884.380	3.2885.380	3.2884.380
400	1.2879.400	1.2878.400	3.2879.400	3.2878.400	400	1.2885.400	1.2884.400	3.2885.400	3.2884.400		
420	1.2879.420	1.2878.420	3.2879.420	3.2878.420	420	1.2885.420	1.2884.420	3.2885.420	3.2884.420		
440	1.2879.440	1.2878.440	3.2879.440	3.2878.440	440	1.2885.440	1.2884.440	3.2885.440	3.2884.440		
460	1.2879.460	1.2878.460	3.2879.460	3.2878.460	460	1.2885.460	1.2884.460	3.2885.460	3.2884.460		
480	1.2879.480	1.2878.480	3.2879.480	3.2878.480	480	1.2885.480	1.2884.480	3.2885.480	3.2884.480		
200	10	1.2881.200									

### IV.7.1. Introduction

Reversed nailing of the femur provides fixation in cases of fractures above the knee joint (up to 20cm from distal end of femur) or multi-fragment fractures of condyle. The reverse nail may also be used when a hip prosthesis or other implant has been already implanted in proximal femur.

**CHARFIX system** provides the reversed nails with diameters 10, 11 or 12mm and length between 160 and 440 mm. To lock the nail distally (by the knee joint) depending on the fracture type use:

- two locking screws 6.5mm,
- two locking sets.

There are five sizes of locking sets:

- 50, with range between 50 and 65 mm,
- 60, with range between 60 and 75 mm,
- 60, with range between 70 and 85 mm,
- 70, with range between 80 and 95 mm,
- 90, with range between 90 and 105 mm.

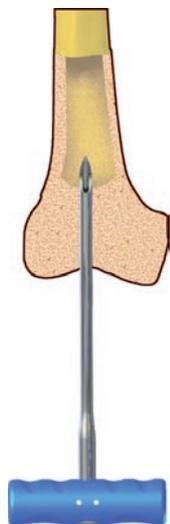
Locking set consists bolt, two washers and locking screw. Locking screws are used to lock the nail proximally. The nail features anatomical shape - its distal end is 5° bent.

Each surgical procedure has to be planned. Before the operation adequate X-Ray have to be made in order to examine the type of fracture and assess the dimensions of implant (diameter and length). The operation should be performed on the patient in supine position, with tourniquet on and the knee joint bent 90°.

Nailing may be performed with or without reaming of medullary canal. In both cases the diameter of medullary canal ought to be bigger than the diameter of used nail; if canal is reamed its final diameter should be 1.5 to 2mm wider than the diameter of the nail. In both cases the canal has to be additionally reamed in distal part (entry point) with a 13.0 reamer at the distance of first 6cm (diameter of the nail in distal end is 12mm).

The following paragraphs describe most important steps during implantation of intramedullary interlocking femur nails nevertheless it is not detailed instruction of use. The surgeon decides about choosing the surgical technique and its application in each individual case.

On the basis of X-Ray of fractured femur and of the healthy one, the surgeon decides about the length and diameter of the nail.

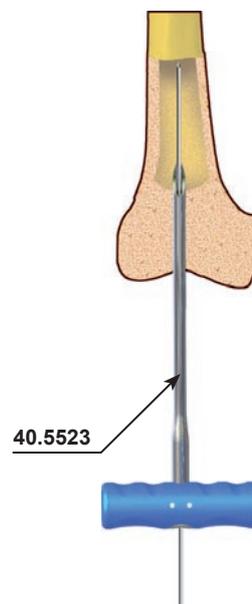


- 1 Make the incision over the middle of patellar ligament or more paracentrally. Expose intercondylar region (split the fibers of ligament or move it laterally). Use the Curved Awl 8.0 [40.5523] to open the medullary canal to depth of about 6 cm.

Control the procedure with the X-Ray.

- 2 After opening the medullary canal, insert the Guide Rod 3.0/580 [40.3925] with fixed the Handle Guide Rod [40.1351] until adequate depth is reached.

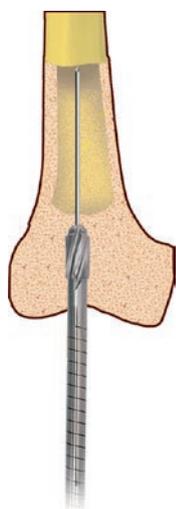
Remove the Guide Rod 3.0/580 [40.3925].  
Remove the Handle Guide Rod [40.1351].



- 3 In case if medullary canal is reamed, gradually increase the diameter of canal with steps of 0.5 mm, until the diameter 1.5 to 2.0 mm wider than the diameter of the femoral nail is reached, for the depth at least equal to the nail length (but not lesser).

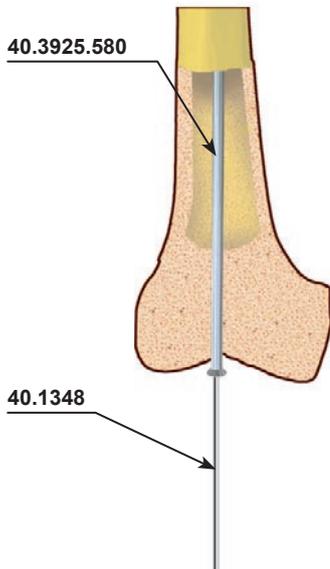
In both cases, when the medullary canal was reamed or not, the canal should be drilled using 13 reamer to the depth of approx. 6 cm

Remove the Flexible Reamer.



The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.

**NOTE!** Steps [4] and [5] are applicable only if the medullary canal has been reamed or if another reamer guide has been used. Otherwise go directly to the step [6].

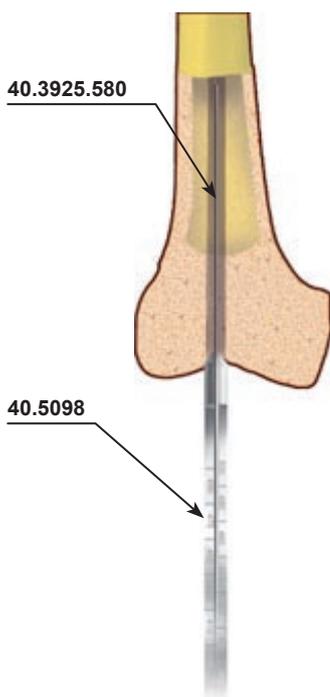
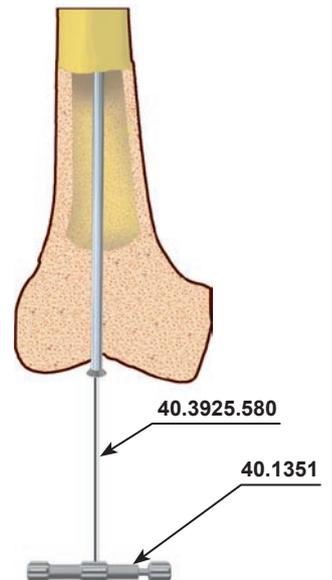


- 4** Insert the Teflon Pipe Guide [40.1348] onto the flexible reamer guide in the medullary canal.

Remove the Reamer Guide.

- 5** Mount the Handle Guide Rod [40.1351] on the Guide Rod [40.3925.580] and advance the rod into the Teflon Pipe Guide until its tip reaches the distal epiphysis.

Remove the Handle Guide Rod [40.1351] from the Guide Rod. Remove the Teflon Pipe Guide [40.1348].



- 6** Insert the Nail Length Measure [40.5098] on the Guide Rod until it rests on bone. Read the length of the nail on the nail measuring gauge. Remove the Nail Length Measure from the guide rod. In case of using solid nail, remove the Guide Rod from medullary canal. Medullary canal is ready for nail insertion.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.7.2. Nail assembling to the target, nail insertion into the medullary canal**



**7** Mount the Distal Target D [40.5093] on the Arm Target [40.5091] using collar bolt (included in distal target).

**NOTE!** When operating right limb the target should be connected so the >>RIGHT<< signs on both side shall be in line. In case of left limb - the >>LEFT<< signs on both side shall be in line.

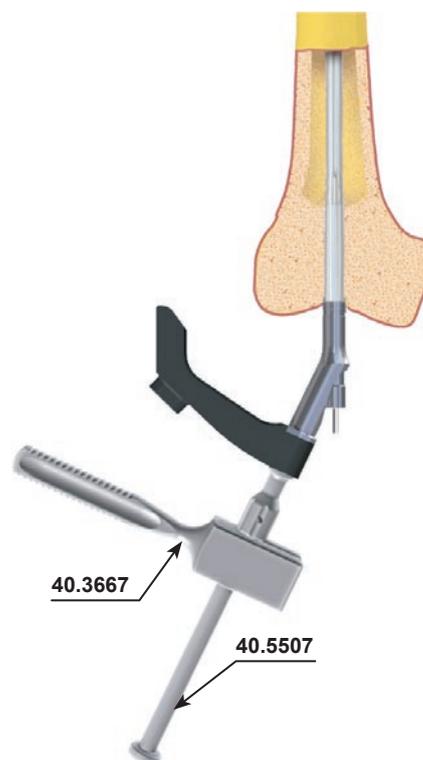
Use the Wrench S10 [40.3336] to mount the intramedullary nail on the distal target with the Connecting Screw M10x1 L=55 [40.5094]. With a pair of the Set Blocks 9/4.5 [40.3616] place the slider of distal target in line with proximal locking holes of intramedullary nail. Secure the slider of the proximal target using the Screwdriver S3.5 [40.3604].

**CHECK!** Properly set and secured slider means that setting pins smoothly hit the holes in the nail.

Remove the Slider of Proximal Target.  
Dismount the Target 135 from the Distal Target.

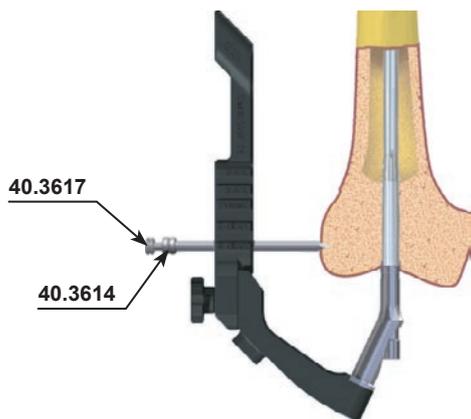
**8** On the Arm Target [40.5091] with attached intramedullary nail insert the Impactor-Extractor [40.5507]. Insert the intramedullary nail into the medullary canal through the Guide Rod 3.0/580 [40.3925]. Advance the nail into the medullary canal until adequate depth is reached.

Remove the Guide Rod 3.0/580 [40.3925].  
Unscrew Impactor-Extractor [40.5507] off the target.



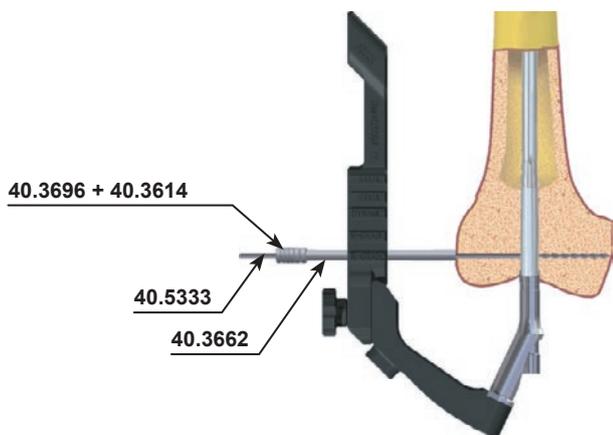
*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.7.3. LOCKING THE NAIL IN THE FEMUR CONDYLAL**



**9** Insert the Target 135 [40.5097] on the Arm Target [40.5091]. Insert the Protective Guides [40.3662] and [40.3614] and the Trocar 6.5 [40.3617] into target hole positioned in the most distal part. Mark the entry point for the trocar and make an adequate incision of the soft tissues. Advance the trocar with protective guides until they reaches the cortex bone. Mark with the trocar the entry point for canal that is to be done for locking screws.

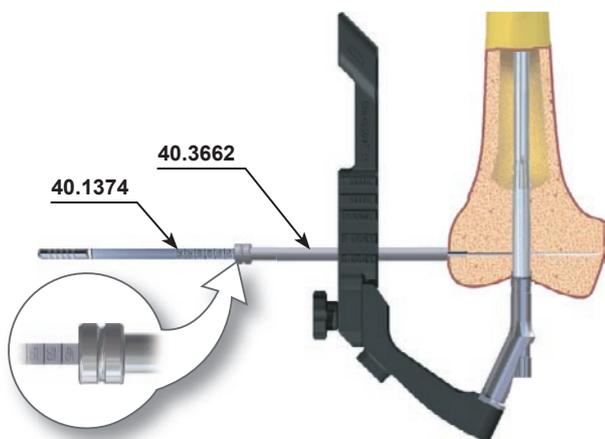
Remove the Trocar.  
Leave the Protective Guides in the hole of the target.



**IV.7.3.a. OPTION I - Locking with screws**

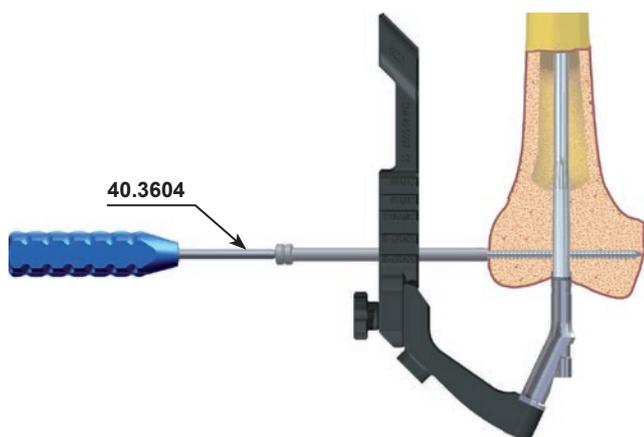
**10** Insert the Drill Guide 6.5/4.5 [40.3696] into the Protective Guides [40.3662] and [40.3614]. Mount the Drill With Scale 4.5/350[40.5333] on the surgical drive and advance it through the drill guide. Drill the hole for locking screw. The scale on the drill shows length of the locking element. Control drilling process with X-Ray.

Remove the Drill and drill guide.  
Leave the Protective Guide in the hole of the target.



**11** Insert the Screw Length Measure [40.1374] through the Protective Guide [40.3328] into the drilled hole until its hook reaches the cortex on the other side of the bone. Read the length of the needed locking screw on the gauge. During the measurement the Protective Guide should rest on the cortex bone.

Remove the Screw Length Gauge.  
Leave the Protective Guide in the hole of the target.



**12** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. 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 protective guide).

Remove the Screwdriver and the Protective Guide.  
For distal locking of the nail use locking screws with diameter 6.5mm.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

## IV.7.3.b. OPTION II - Locking with locking set

- 13** The Drill Guide [40.3614] and the Protective Guide [40.3662] are in the hole of target. Mount the Drill 6.5/350 [40.2068] on the surgical drive and advance it through the Drill Guide. Drill the hole through the bone. Control drilling with X-Rays image intensifier. With help of X-Ray image intensifier make incision of the soft tissues over the exit point of the drill.

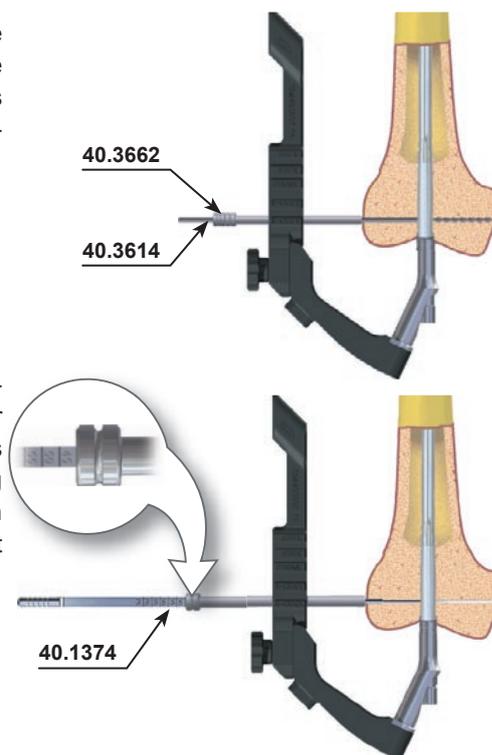
Remove the Drill.

Leave the Protective Guides [40.3662] and [40.3614] on Target.

- 14** Insert the the Reconstruction Screw Length Measure [40.3332] through the Protective Guide into the drilled hole until its hook reaches the cortex on the other side of the bone. Deduct 10mm from the reading on the gauge, to get a characteristics of the locking set needed. Select locking set with adequate range, e.g. with reading "75" the characteristics amounts to "65", therefore locking set 60 with range between 60 and 75 mm is adequate. During the measurement the Protective Guide should rest on the cortex bone.

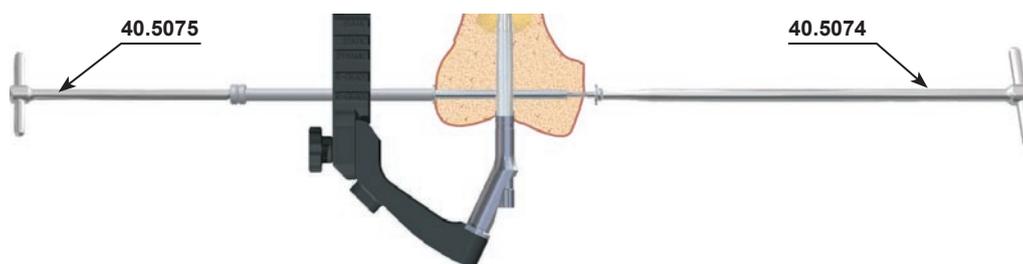
Remove the screw length gauge.

Leave the protective guide in the hole of the target.



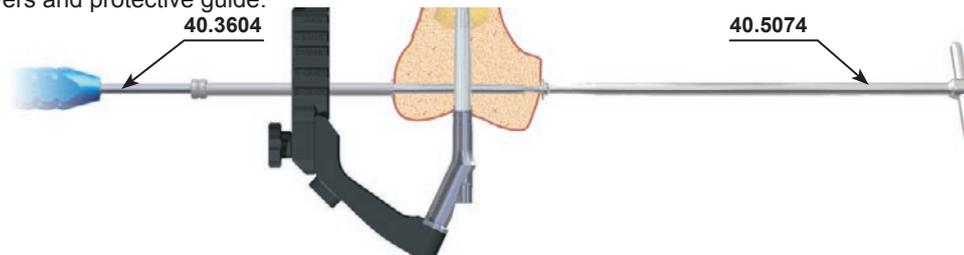
- 15** Insert the Bolt Guide [40.5075] into the protective guide. The pilot which is integral part of the the Bolt Guide [40.5075], should be attached on the Bolt Guide. Advance the Bolt Guide through the drilled hole until its tip reaches the hole from the other side. Remove the pilot from the the Bolt Guide. Put the bolt (implant) through the washer (implant) and screw it in onto the the Bolt Guide using the Screwdriver S3.5 [40.5074]. Advance the bolt into the hole in the bone (head of the bolt should rest on the cortex with washer between).

Unscrew the Bolt Guide from the bolt and remove it from the Protective Guide.



- 16** Leave the Protective Guide [40.3328] in the hole of the target. Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the securing screw (implant) and advance both into the Protective Guide. Put the washer (implant) over the locking screw when it leaves the protective guide and enters the hole in the bone. Insert the locking screw in the threaded hole in the bolt (hold the bolt with the screwdriver). Two screwdrivers are used to secure the locking set (securing screw, two washers, bolt).

Remove the screwdrivers and protective guide.



**NOTE!** To secure second locking set for the other distal hole follow the steps [13] to [16].

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

**IV.7.4. Proximal locking of the nail**

Before continuing with steps connected with proximal locking of the nail do the following:

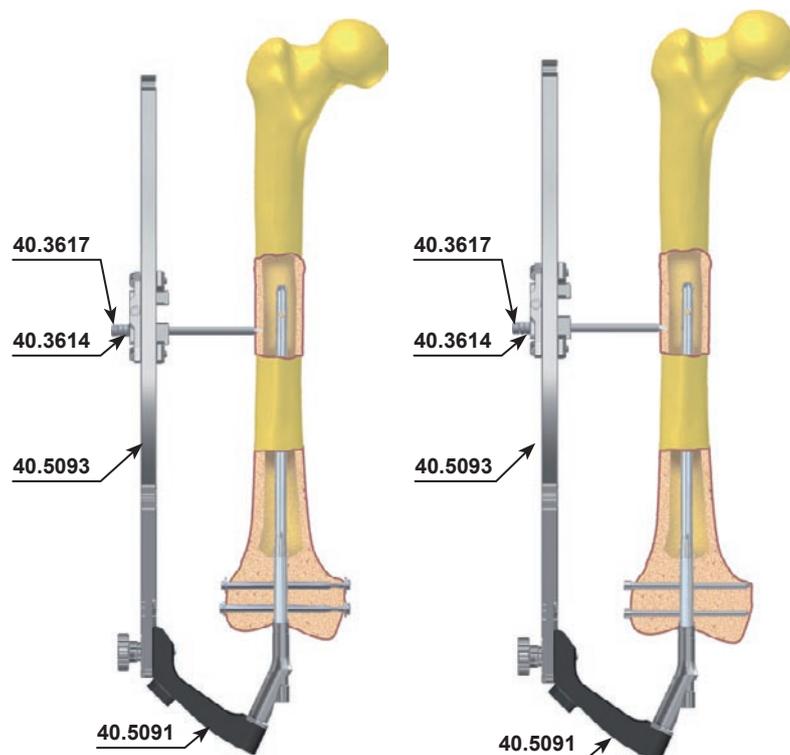
1. Mount the Distal Target D [40.5093] on the Arm Target [40.5091] and secure it with a collar bolt (included in distal target).

If properly installed, the signs >>RIGHT<< or >>LEFT<< on both target should comply (in one plane).

2. Verify with the X-Ray image intensifier the position of holes in the nail and in the target slider. The centers of the holes have to be in line.

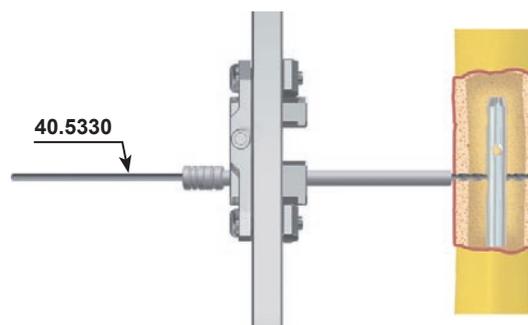
- 17 Insert the Protective Guide 9/4.5 [40.3614] with the Trocar 6.5 [40.3617] into the distal hole in the Distal Target D [40.5093] target. Mark the entry point for the Trocar, make an adequate incision of the soft tissues. Advance the trocar together with protective guide until it reaches the cortex bone. Using Trocar mark the entry point for locking screw.

Remove the trocar.  
Leave the Protective Guide in the hole of the target.



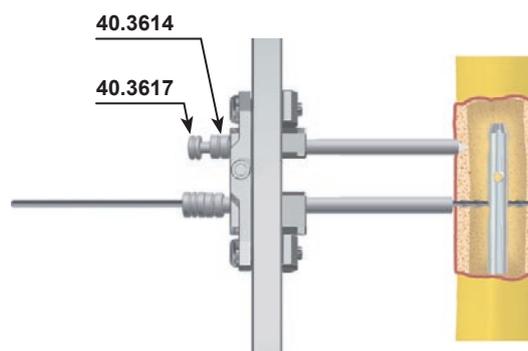
- 18 Insert the Drill Guide 6.5/3.5 [40.3615] (with two grooves) into the Protective Guide 9/4.5 [40.3614] left in the hole of the slider. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the drill guide. The scale on the drill shows length of the locking element. Drill the hole in the femoral shaft through both cortex layers and the nail hole.

Disconnect the drive from the drill and leave in place system: the protective guide - drill guide - drill.

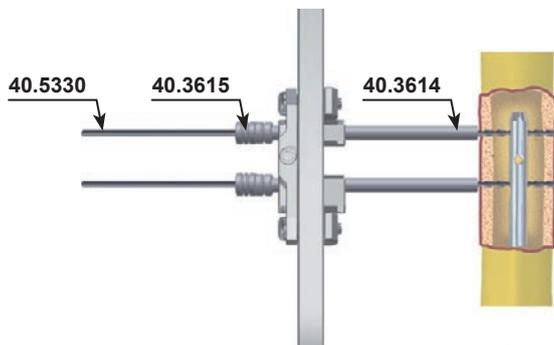


- 19 Insert the Protective Guide 9/4.5 [40.3614] (with one groove) with the Trocar 6.5 [40.3617] into the second hole in the slider of the target. Advance the trocar until it reaches the cortex bone and mark the entry point for the drill. Advance the Protective Guide together with the Trocar until it touches the bone.

Remove the Trocar.  
Leave the Protective Guide in the hole of the slider.

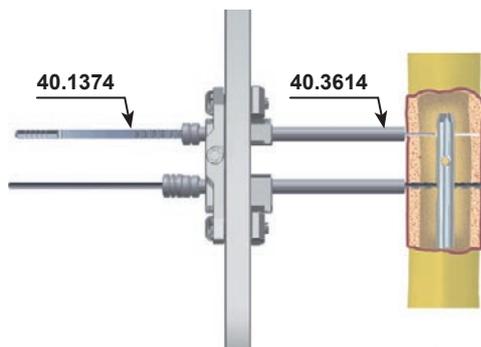


*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*



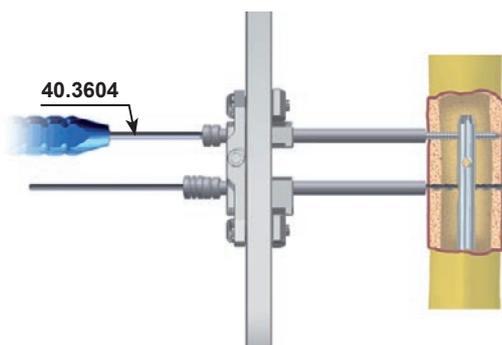
**20** Insert the Drill Guide 6.5/3.5 [40.3615] into the Protective Guide 9/4.5 [40.3614]. Mount the Drill With Scale 3.5/250 [40.5330] on the surgical drive and advance it through the drill guide. Drill the hole in the femoral shaft through both cortex layers and the nail hole. The scale on the drill shows length of the locking element.

Remove the Drill and Drill Guide.  
Leave the Protective Guide in the hole of the slider.



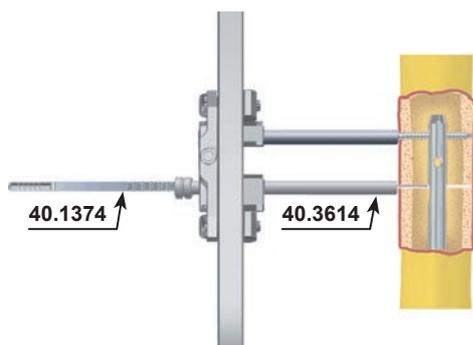
**21** Insert the Screw Length Measure [40.1374] through the Protective Guide 9/4.5 [40.3614] into the drilled hole until its hook reaches the „exit” plain of the bone. Read the length of the locking screw on the gauge B-D scale. During the measurement the Protective Guide should rest on the cortex bone.

Remove the Screw Length Measure.  
Leave the Protective Guide in the hole of the target.



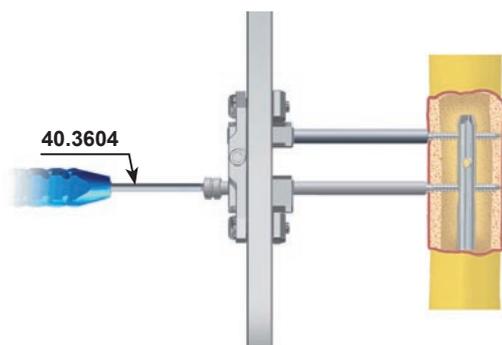
**22** Insert the tip of the Screwdriver S3.5 [40.3604] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. Insert the locking screw in the prepared hole until the head of the screw reaches the cortex of the bone (the groove on the screwdriver shaft matches the edge of protective guide).

Remove the Screwdriver.  
Leave the Protective Guide.



**23** Remove the drill from distal hole in the target. Leave the Protective Guide in the hole of the slider. Insert the Screw Length Measure [40.1374] 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 the gauge B-D scale. During the measurement the Protective Guide should rest on the cortex bone.

Remove the Screw Length Gauge.  
Leave the Protective Guide in the hole of the target.



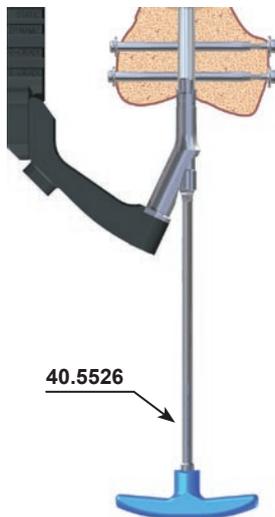
**24** Insert the tip of the Screwdriver [40.3619] into the hexagonal socket of the selected locking screw. Then advance both into the Protective Guide. Insert the locking screw in the prepared hole until the head of the screw reaches the cortex of the bone (the groove on the screwdriver shaft matches the edge of protective guide).

Remove the Screwdriver and Protective Guide.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*

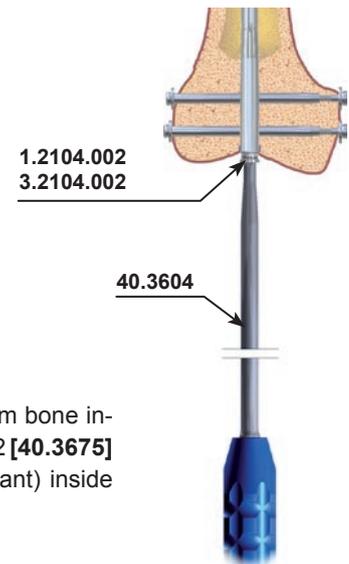
**NOTE!** Proximal locking of the nail may be also performed using freehand technique. The procedure is described within reconstructive method. Refer to steps [35] to [38].

#### IV.7.5. Target removal and end cap placing



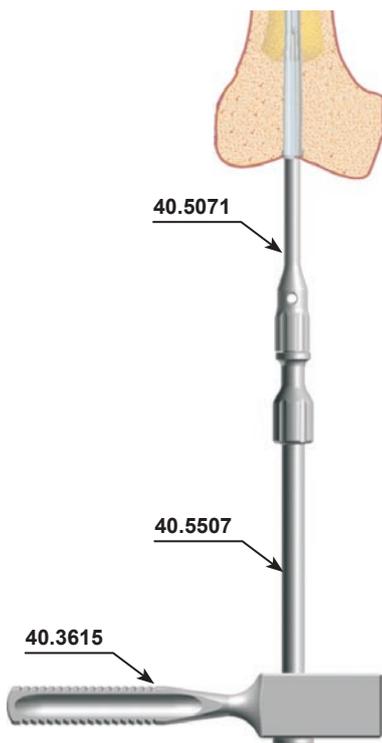
- 25** Using the Wrench S10 [40.5526] unscrew the Connecting Screw M10x1 L=55 [40.5094] out of the nail shaft and dismount the target from the nail locked in the medullary canal.

Dismount the target.



- 26** In order to secure the inner thread of the nail from bone ingrowth, using the Cannulated Screwdriver S5.0/2.2 [40.3675] insert the End Cap [1.2104.002] or [3.2104.002] (implant) inside the.

#### IV.7.6. Nail extraction



- 27** Use the Screwdriver S3.5 [40.3604] to remove the End Cap from the nail shaft. Using the Screwdriver S3.5 [40.3604] unscrew all the locking screws (use 2 screwdrivers to remove locking set). Using the wrench insert the Connector [40.5071] into the threaded hole in the nail. Attach the Impactor - Extractor [40.5507] to the connector and using the Mallet [40.3667] extract the nail from the medullary canal.

*The above description is not detailed instruction of conduct. The surgeon decides about choosing the operating procedure.*





# REUSABLE ORTHOPAEDIC AND SURGICAL INSTRUMENTS

ChM<sup>®</sup>

Instruments manufactured by ChM Ltd. are made of stainless steel, aluminium alloys and plastics according to ISO standards. Each medical instrument is exposed to occurrence of corrosion, stains and damage, if not treated with special care and recommendations below.

## 1. Materials

Devices are produced of corrosion-resistant steels. The protective layer (passive layer) against corrosion is formed on the surface of the stainless steel due to high content of chromium.

Devices produced of aluminium are mainly stands, palettes, cuvettes and some parts of instruments such as handles of screwdriver, awl or wrench, etc. The protective oxide layer, which may be dyed or stay in natural colour (silvery-grey), is formed on the aluminium as an effect of electrochemical surface treatment on its surface.

Devices made of aluminium with processed layer have a good corrosion resistance. The contact with strong alkaline cleaning and disinfecting agents, solutions containing iodine or some metal salts due to chemical interference on the processed aluminium surface shall be avoided.

Devices are mainly manufactured out of following plastics: POM-C (Polyoxymethylene Copolymer), PEEK (Polyetheretherketone) and teflon (PTFE). The above mentioned materials can be processed (washed, cleaned, sterilized) at temperatures not higher than 140°C, they are stable in aqueous solution of washing-disinfection with pH values from 4 to 9.5.



*If the material of the device cannot be specified, please contact ChM Ltd. company representative.*

## 2. Disinfection and cleaning

Effective cleaning is a complicated procedure depending on the following factors: the quality of water, the type and the quality of used detergent, the technique of cleaning (manual/machine), the correct rinsing and drying, the proper preparation of the instrument, the time, the temperature. Internal procedures of sterilizers, recommendations of cleaning and disinfection agents, as well as recommendations for cleaning and sterilizing automatic machines shall be observed.



*Read and follow the instructions and restrictions specified by the manufactures of the agents used for disinfection and cleaning procedures.*

1. Before the first use, the product has to be thoroughly washed in the warm water with washing-disinfecting detergent. It is important to follow the instructions and restrictions specified by the producer of those detergent. It is recommended to use water solutions of cleaning-disinfection agents with a neutral pH.
2. After use, for at least 10 minutes the product has to be immediately soaked in an aqueous disinfectant solution of enzyme detergent with a neutral pH (with a disinfection properties) normally used for reusable medical devices (remember to prevent drying out any organic remains on the product surface). Follow all the instructions specified by the producer of those enzyme detergents.
3. Carefully scrub/clean the surfaces and crevices of the product using a soft cloth without leaving threads, or brushes made of plastic, only the nylon brushes are recommended. Do not use brushes made of metal, bristles or damaging material as they can cause physical or chemical corrosion.
4. Next, thoroughly rinse the instrument under the warm running water, paying particular attention for carefully rinsing the slots. Use nylon brushes making multiple moves back and forth on the surface of the product. It is recommended to rinse in demineralized water, in order to avoid water stains and corrosion caused by chlorides, found in the ordinary water, and to avoid forming the stains on the surface such as anodized. During the rinsing manually remove the adherent remains.
5. Visually inspect the entire surface of the product to ensure that all contaminations are removed.



*If there are any residues of human tissue or any other contamination, repeat all stages of the cleaning process.*

6. Then, the instrument has to undergo a process of machine washing in the washer-disinfector (use washing-disinfecting agents recommended for reusable medical devices and instruments).



*Procedure of washing with the washer-disinfector shall be performed according to internal hospital procedures, recommendations of the washing machine manufacturer, and instructions for use prepared by the washing-disinfection agents manufacturer.*

## 3. Sterilization

Before each sterilization procedure and application, the device has to be controlled. The device is to be efficient, without toxic compounds as residues after disinfection and sterilization processes, without structure damages (cracks, fractures, bending, peeling). Remember that sterilization is not substitute for cleaning process!



*Devices manufactured out of plastics (PEEK, PTFE, POM-C) may be sterilized by any other available sterilization method validated in the centre but the sterilization temperature is not to be higher than 140°C.*

Sterilization of surgical instruments shall be carried out using equipment and under the conditions that conform to applicable standards. It is recommended to sterilize in steam sterilizers where sterilizing agent is water vapour. Recommended parameters of the sterilization method: temperature min. 134°C, pressure of 2 atm.



*The above given parameters of sterilization are to be absolutely observed.*

Validated sterilization methods are allowed. Durability and strength of instruments highly depend on their usage. Careful usage consistent with intended application of the product, prevents product damaging and prolongs its life.

# ChM®

## ChM Ltd.

Lewickie 3b  
16-061 Juchnowiec K.  
Poland

tel. +48 85 713-13-20  
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