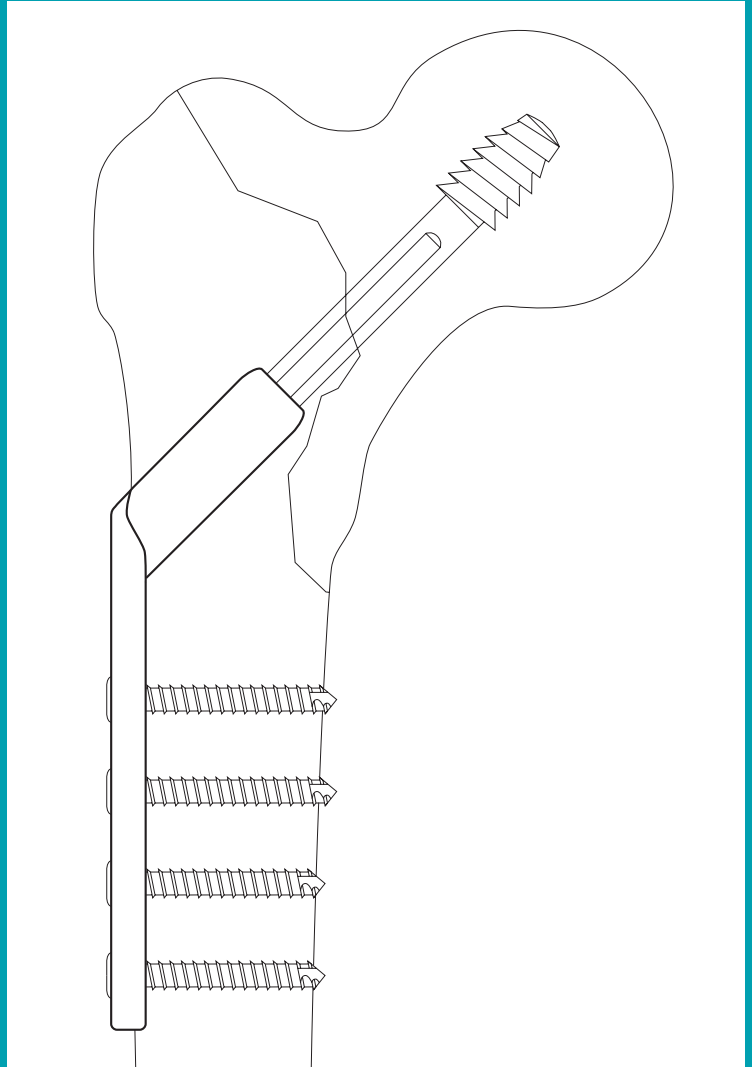


# DHS/DCS Standard System

## Surgical Technique



**SYNTHES**<sup>®</sup>

Original Instruments and Implants of the  
Association for the Study of Internal Fixation –  
AO/ASIF

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 Image intensifier control

**Warning**

This description is not sufficient for immediate application of the instrumentation. Instruction by a surgeon experienced in handling this instrumentation is highly recommended.

## Implants

### DHS® Plates 130°–150° (281.040–560)

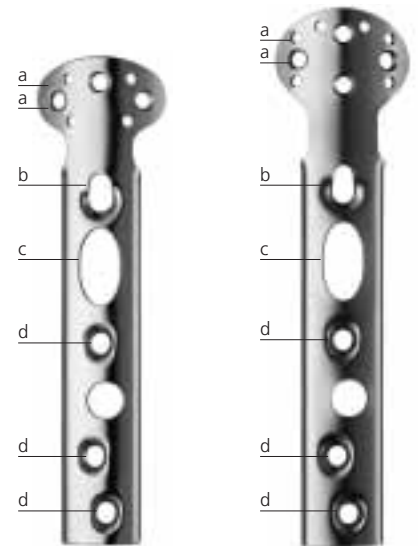
- Steel
- Fixation with cortex screws  $\varnothing$  4.5 mm
- Lengths: 43–270 mm (2–16 holes)
- Thickness: 5.8 mm
- Width: 19 mm
- Hole spacing: 16 mm
- Barrel lengths: 25–38 mm



### DHS Trochanter Stabilizing Plates (281.869/870)

The DHS trochanter stabilizing plates offer anchoring options for the fixation of fragments of the greater trochanter (a), an aperture for an anti-rotation screw (b), an oval aperture for the DHS/DCS screw (c) and holes for fixation to the DHS plate (d). The scooped section can be adapted to the anatomical contours of the greater trochanter using bending irons or flat-nosed pliers.

- for use with DHS plates
- Steel
- Short: 138 mm
- Long: 148 mm



### Anti-rotation screw

The anti-rotation screw can be used on its own, with the DHS plate, or the DHS plate and the DHS trochanter stabilizing plate. The screw effectively prevents rotation of the head-neck fragment of the femur around the DHS screw.

- Cancellous bone screw  $\varnothing$  6.5 mm, steel (214.814–910)
- Cannulated screw  $\varnothing$  7.0 or 7.3 mm, steel



### DCS Plates (281.900–990)

- Steel
- Fixation with cortex screws  $\varnothing$  4.5 mm
- Lengths: 114–370 mm (6–22 holes)
- Thickness: 5.4 mm
- Width: 16 mm
- Hole spacing: 16 mm
- Barrel length: 25 mm



### DHS/DCS Screws (280.000–950)

- Steel
- Lengths: 50–145 mm
- Thread diameter: 12.5 mm
- Thread length: 22 mm
- Shaft diameter: 8.0 mm



### DHS/DCS Compression Screw (280.990)

The compression screw is used together with the DHS and DCS plates.

It is used in pertrochanteric fractures to compress the femoral fragments on the proximal and distal sides of the fracture.

The DHS/DCS compression screw must be used if a DCS plate is applied to the distal femur.

- Steel
- Inner hexagon for Hexagonal Screwdriver 314.120 and 314.270
- Length: 36 mm



### DHS Locking Device (280.960)

The DHS locking device is used together with the DHS for temporary locking of the sliding mechanism of the DHS/DCS screw.

- Steel
- Inner hexagon for DHS Torque-indicating Screwdriver 338.560
- Length: 35 mm



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**Indications for DHS plates**

- Pertrochanteric and intertrochanteric fractures of type 31-A in the AO/ASIF classification.

For highly unstable types of fracture, additional implants such as the DHS trochanter stabilizing plate or DHS locking device may be required.

- Femoral neck fractures 31-B2/B3, in conjunction with the use of an anti-rotation screw.

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**Indications for DHS trochanter stabilizing plates**

- Group 31-A2 and A3 fractures, particularly multifragment fractures.

The DHS Trochanter Stabilizing Plates (281.869 and 281.870) are viewed as an extension of the DHS plate for stabilizing the greater trochanter and for accepting an anti-rotation screw.

Where telescoping is present in the fracture zone, the combination of a DHS plate and a DHS trochanter stabilizing plate prevents the tendency of the trochanter fragments to move laterally with consequent medialization of the shaft in relation to the head-neck fragment. Additionally, a rotationally unstable head-neck fragment can be stabilized by inserting an anti-rotation screw cranially and parallel to the DHS/DCS screw.

DHS trochanter stabilizing plates can also be used to secure splintered greater trochanter fragments and stabilize them by using screws or cerclage wires in the scooped section of the DHS trochanter stabilizing plate.

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### **Indications for DCS plates**

- Proximal femur: very proximally located, purely sub-trochanteric fractures of types 32-A 1.1, A 2.1, A 3.1; 32-B 1.1, B 2.1, B.3.1.
- Fractures of type 33-A (extra-articular, supracondylar fractures of the distal femur)
- Fractures of type 33-C1/C2/C3 (fully articular fractures of the distal femur)

### **Contraindications for DCS plates**

- Pertrochanteric fractures or trochanteric fractures extending to the subtrochanter.

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### **Indications for the DHS locking device**

The locking device is used if there is a risk of severe shortening of the femoral neck due to telescoping of the head fragment.

- Group A 2 and A 3 fractures in young patients, particularly fractures with a comminuted zone.
  - A 2.2 With several intermediate fragments
  - A 2.3 Fracture extending more than 1 cm below the lesser trochanter
  - A 3.3 Multifragment fractures

### **Contraindication for locking device**

- Osteoporotic bone

## DHS plate

### 1

#### Position patient

Place the patient in a supine position on the operating table.

### 2

#### Reduce fracture



If possible reduce the fracture while closed under the image intensifier.

If an operating table without extension is used, reduce the fracture by flexion, lengthwise traction, abduction and internal rotation. Fix the fracture temporarily with Kirschner wires. Position the Kirschner wires so that they do not hamper insertion of the DHS/DCS screw and DHS plate.

### 3

#### Access

The proximal femur is approached laterally. Make a 15–20 cm straight incision starting two fingerwidths proximal to the greater trochanter.

Split the iliotibial tract lengthwise. Detach the M. vastus lateralis dorsally from the intermuscular membrane, retract ventrally and, if necessary, make a slight notch in the muscle in the region of the innominate tubercle. Expose the proximal femoral shaft without retracting the periosteum.

### 4

#### Determine antetorsion

To determine the antetorsion of the femoral neck using the DHS Angled Guide (358.005–040) and the DHS/DCS T-Handle (338.080), place a Kirschner wire ventrally over the femoral neck and tap the tip slightly into the femoral head.

## 5

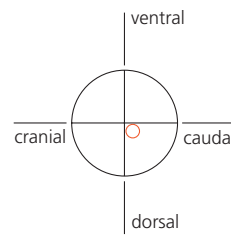
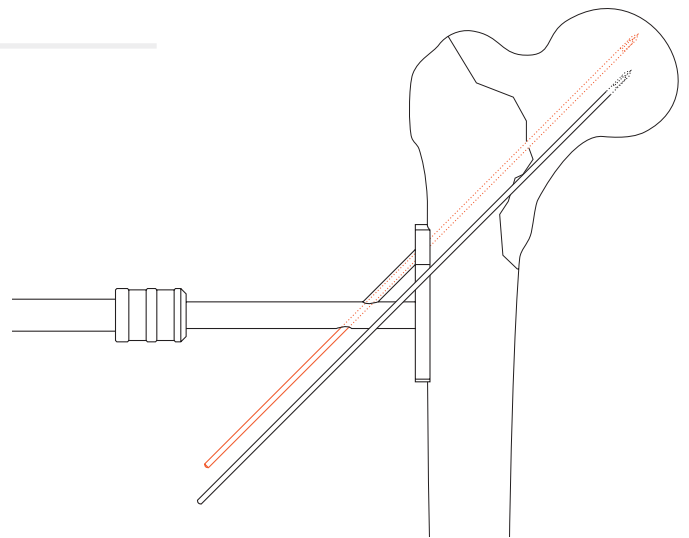
### Determine entry point for the DHS/DCS screw and insert guide wire

Implants with CCD angles from 130° to 150° are available. Depending on the angle of the implant, the entry point for the DHS/DCS screw is approx. 2.5–6.0 cm distal to the innominate tubercle.

Locate the DHS angled guide and drill the outer cortex using the Drill Bit  $\varnothing$  2.0 mm (310.190). Insert the DHS/DCS Guide Wire with Threaded Tip  $\varnothing$  2.5 mm (338.000) until the tip reaches the subchondral part of the femur head.

The guide wire runs approximately 6 mm proximal to Adams' arc in the dorsocaudal quadrant of the femoral head. The thread on the tip of the guide wire stops the wire from being pulled out. Check the position of the guide wire under the image intensifier in the a.p. view and the Lauenstein position. If an extension table is used, record an axial view.

**Note:** Leave the guide wire in the femur until the plate is fitted (step 9, page 9). If the guide wire is not correctly positioned it must be reinserted. Once the DHS/DCS screw is inserted in an incorrect position, no subsequent correction is possible.

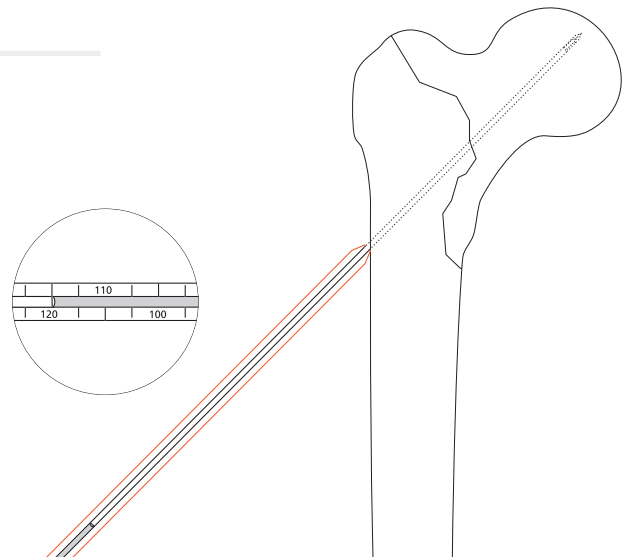


## 6

### Measure the length of the guide wire

Slide the DHS/DCS Direct Measuring Device (338.050) over the guide wire and measure the length of the guide wire in the bone (e.g. 120 mm).

Remove the antetorsion Kirschner wire.



# 7

## Reaming

Assemble the DHS triple reamer: Slide the DHS Reamer (338.110 or 338.440) over the Drill Bit  $\varnothing$  8.0 mm (338.100) until it clicks into place at the selected mark (in this example at 110 mm). The reaming depth can be adjusted in 5 mm increments. Secure the reamer by tightening the Knurled Nut (338.120).

Adjust the reaming depth on the DHS Triple Reamer (338.130). The appropriate reaming depth is 10 mm less than the measured length of the guide wire (in this example  $120 \text{ mm} - 10 \text{ mm} = 110 \text{ mm}$ ).

Ream the screw channel until the tip of the reamer is 10 mm in the subchondral part of the femoral head.

The length of the appropriate DHS/DCS screw is identical to the reaming depth (in this example 110 mm).

**Notes:** While reaming, ensure that the guide wire does not bend. Bending the guide wire can result in incorrect placement of the DHS plate and DHS/DCS screw.

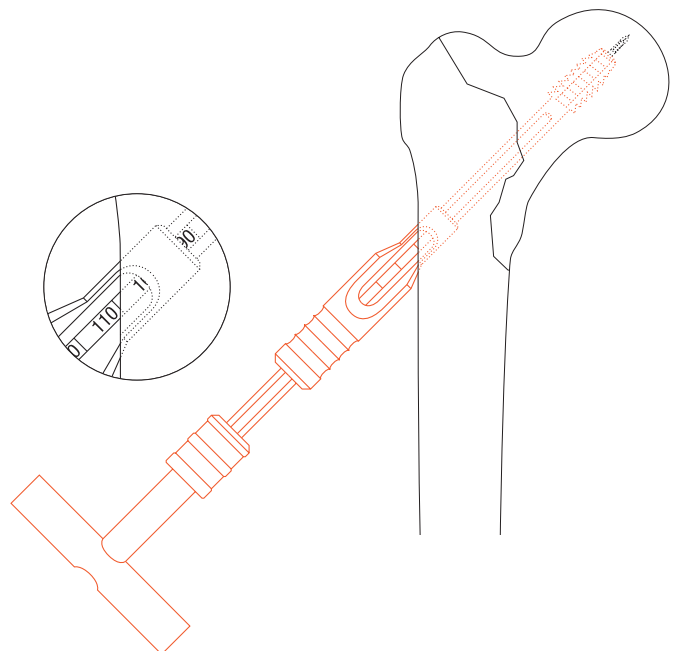
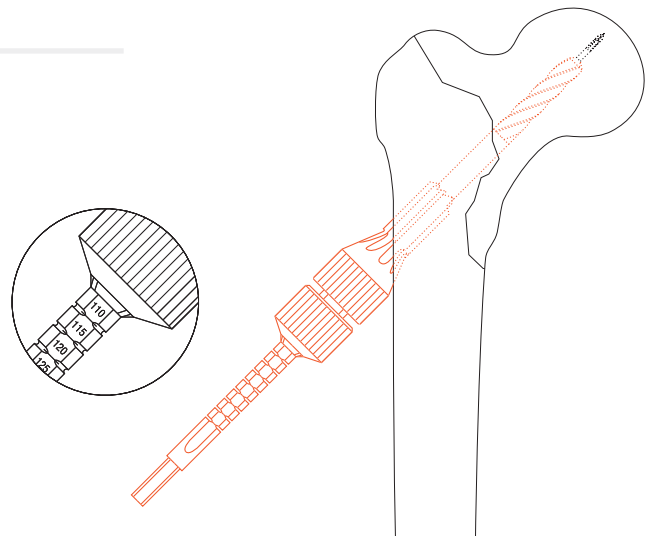
If the guide wire is pulled out during reaming it must be replaced. Push the short DHS Centering Sleeve (338.180) into the drill hole and insert a DHS/DCS screw with the shaft foremost into the centering sleeve. The guide wire can now easily be reinserted back in its original position.

Remove the DHS triple reamer.

## Option

In case of hard bone, tap the thread using the DHS/DCS Tap (388.170) and the short DHS/DCS Centering Sleeve (388.180). Tap the thread until the selected depth in the small window of the centering sleeve reaches the lateral cortex (in this example 100 mm).

**Note:** The DHS/DCS tap may not be used in osteoporotic bone.



## 8

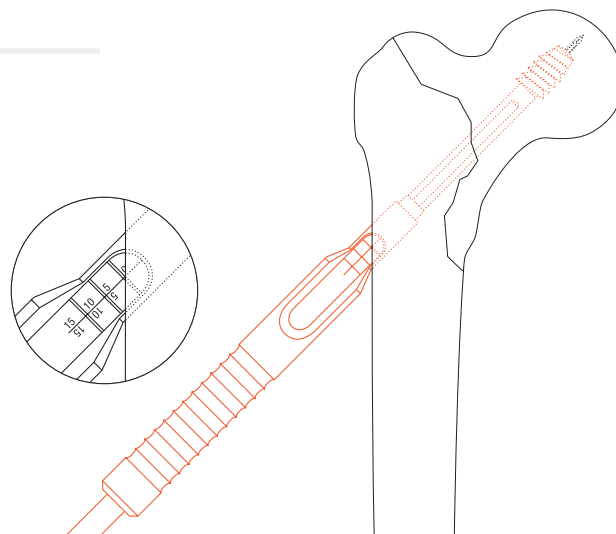
### Insert the DHS/DCS screw

Slide the insertion instruments (see page 17 for assembly) over the guide wire and advance the long Centering Sleeve (388.190) into the drilled hole. Insert the DHS/DCS screw (in this example 110 mm) until the zero mark reaches the lateral cortex. Continue inserting the screw for a further 5 mm if the bone is osteoporotic.

The handle of the DHS/DCS Wrench (338.060) must remain parallel to the femoral axis since only in this screw position can the DHS plate be positioned correctly over the flat-sided shaft of the DHS/DCS screw against the femoral shaft.

**Note:** Do not use the DHS/DCS wrench to reduce the fracture as this only allows limited transmission of forces.

Remove the DHS/DCS wrench and the long centering sleeve.

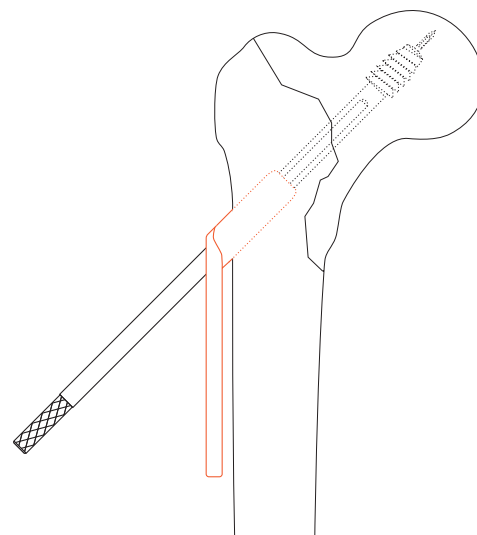


## 9

### Position DHS plate

Position the DHS plate over the short Connecting Screw (338.200) against the femoral shaft. Loosen the connecting screw and remove the Guide Shaft (338.210).

Set the power tool to reverse operation to remove the guide wire. Dispose of the guide wire.



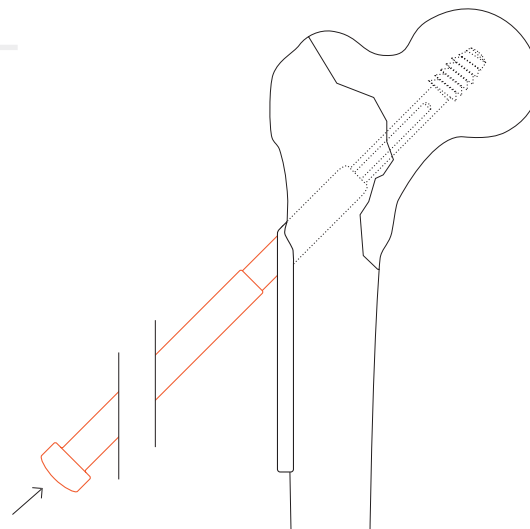
## 10

### Tap DHS plate

Tap the DHS plate into the predrilled channel using the DHS/DCS Impactor (388.140). Compress the fracture by gentle hammer taps against the impactor.

### Option

Where a Trochanter Stabilizing Plate (281.869 or 281.870) is indicated, perform steps 11b–13b on page 11.



## 11a

### Fix DHS plate

Using the DCP Hip Drill Guide 4.5 (322.430) and the Drill Bit  $\varnothing$  3.2 mm (310.310), drill neutral holes through the plate holes.

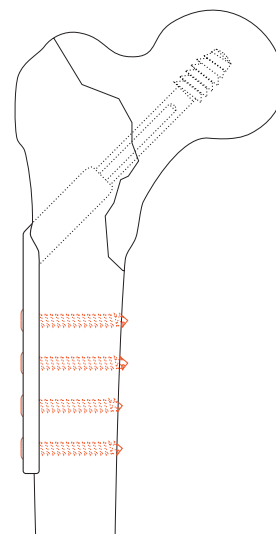
Fix the DHS plate using cortex screws  $\varnothing$  4.5 mm of the appropriate length.

### Option

The fracture fragments can also be compressed with the DHS/DCS Compression Screw (280.990). First fix the plate to the femoral shaft with screws. Insert and tighten the compression screw.

Particularly if the bone is osteoporotic, insert the compression screw carefully and ensure that the thread is not stripped.

The compression screw can then be removed.



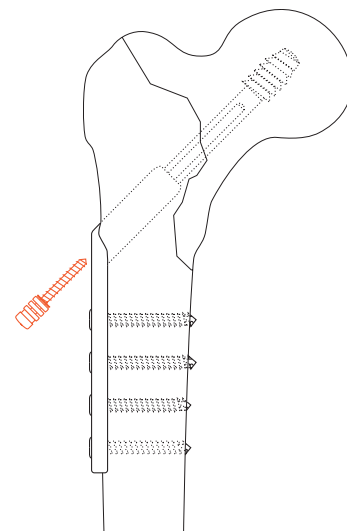
## 12a

### Insert DHS locking device (Option)

The DHS Locking Device (280.960) is used to temporarily block the sliding mechanism.

In order to fully countersink the DHS locking device in the DHS plate barrel, the selected DHS/DCS screw must be 10 mm shorter (step 8, page 9) than the reaming depth (in this example 100 mm). The DHS/DCS screw must then be inserted 10 mm deeper, i.e. until the «10» mark on the DHS/DCS wrench reaches the lateral cortex.

Tighten and secure the DHS locking device using the DHS Torque-indicating Screwdriver (338.560). To ensure that an optimal locking force is achieved, the locking device must be tightened to a torque of 4 Nm.



## DHS trochanter stabilizing plate

### 11b

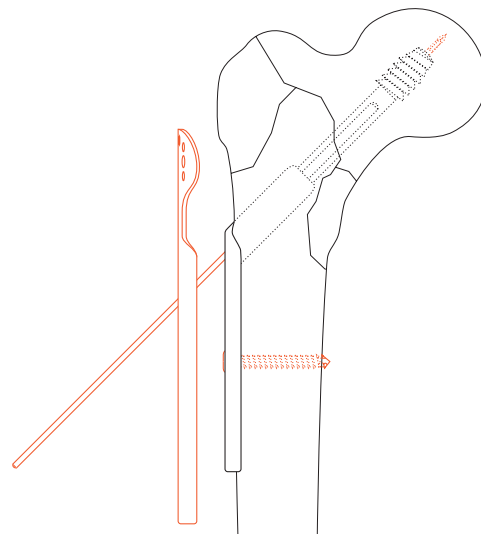
#### Position DHS trochanter stabilizing plate on DHS plate

Insert the DHS/DCS screw and DHS plate as described in steps 1 to 10. If an anti-rotation screw is to be used, the DHS/DCS screw must be inserted in a slightly more caudal direction than for the standard technique.

Fix the DHS plate by inserting a cortex screw  $\varnothing$  4.5 mm through the second proximal plate hole and insert a new guide wire.

Locate the DHS trochanter stabilizing plate flush against the DHS plate.

**Note:** The scooped section of the DHS trochanter stabilizing plate can be shaped beforehand using parallel flat-nosed pliers or a bending iron.



### 12b

#### Fix plates

Fix the DHS trochanter stabilizing plate and the DHS plate using cortex screws  $\varnothing$  4.5 mm of the appropriate length.

Depending on the indication, individual fracture fragments of the greater trochanter can be fixed against the scooped section of the DHS trochanter stabilizing plate using screws  $\varnothing$  4.0 mm or cerclage wires.

### 13b

#### Insert anti-rotation screw (option)

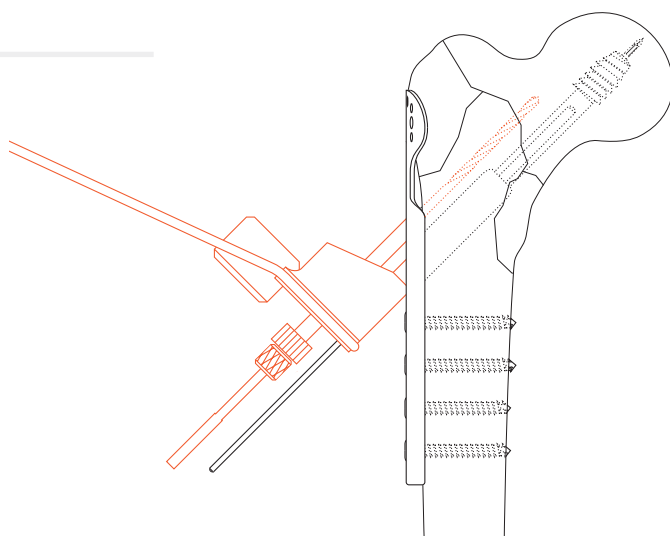
An anti-rotation screw can be inserted cranially and parallel to the DHS/DCS screw.

Cancellous bone screws  $\varnothing$  6.5 mm (with the Drill Sleeve System 338.730 and 338.740), cannulated screws  $\varnothing$  7.0 mm (with the Drill Sleeve System 338.720 and 338.740) and cannulated screws  $\varnothing$  7.3 mm (with the Drill Sleeve System 338.731 and 338.740) can be used.

Position the DHS Parallel Drill Guide (338.750) over the guide wire (aperture with the 0 mark). Insert the appropriate drill sleeve system in the 12 mark of the guide. For the cancellous bone screws  $\varnothing$  6.5 mm tap a threaded hole. For cannulated screws  $\varnothing$  7.0 mm and  $\varnothing$  7.3 mm, insert a guide wire.

Insert the screw according to the usual insertion technique.

Remove the guide wire.



The following surgical technique is illustrated using the example of a fracture of the distal femur.

The DCS plate 95° can also be used on the proximal femur using the same technique. To determine the entry point on the proximal femur see step 4, page 13.

# 1

## **Position patient**

Place the patient in a supine position on a normal radiolucent operating table such that the knee can be flexed through 90°.

# 2

## **Access**

Access is via a 15–20 cm incision along the connecting line between the greater trochanter, the lateral femoral condyle and the tibial tuberosity.

# 3

## **Reduce articular fracture component**

Temporary fixation with Kirschner wires, which are subsequently replaced by lag screws. The position of these screws must not hamper the insertion of the DCS/DCS screw.

## 4

### Determine entry point for the DHS/DCS screw and insert guide wire

The entry point for the DHS/DCS screw is on the femoral shaft approx. 2 cm from the knee joint.

Using two Kirschner wires determine the correct alignment of the DHS/DCS screw.

- The first Kirschner wire in the frontal plane (a) marks the orientation of the knee joint cavity at the level of the condyles.
- Insert the second Kirschner wire (b) ventrally over the lateral and medial condyles to demonstrate the incline of the femoropatellar joint surface.
- Insert the DHS/DCS Guide Wire  $\varnothing$  2.5 mm (338.000) (c) at the predetermined entry point such that it runs parallel both to the first Kirschner wire (a) in a.p. view and to the second, ventrally located wire (b) in the axial view. Insert the guide wire until the medial cortex is reached.

Remove the Kirschner wires.

### Determine entry point in the proximal femur

Using the Condylar Plate Guide (333.200), determine the correct alignment of the DHS/DCS guide wire.

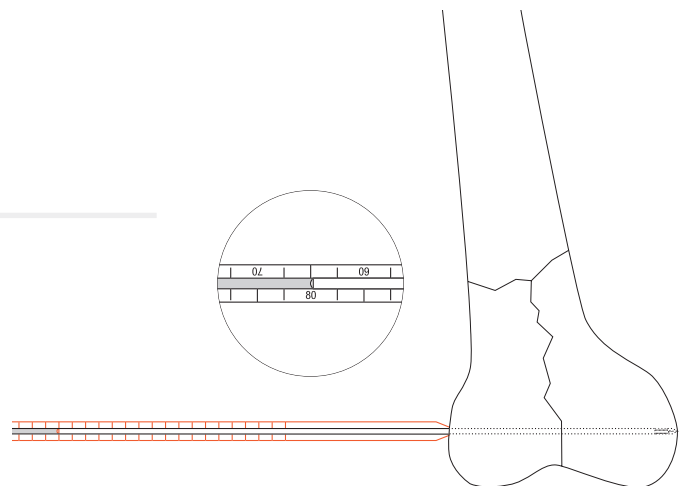
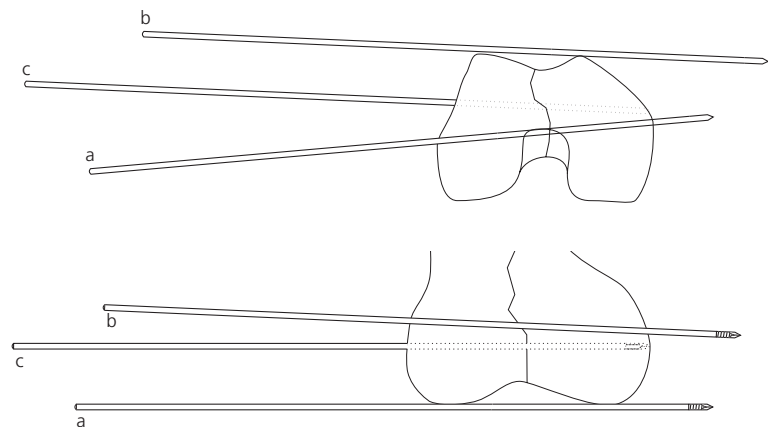
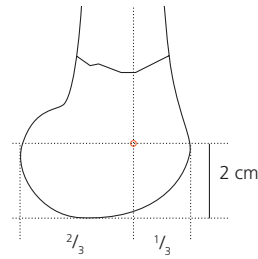
The entry point is located at the transition from the ventral third to the mid-third of the greater trochanter, since the guide wire in the femoral neck – in relation to the Lauenstein projection – must be inserted in the centre.

Determine the  $95^\circ$  alignment to the axis of the femoral shaft using the DCS Angled Guide (338.420) or the Condylar Plate Guide (333.200).

## 5

### Measure the length of the guide wire

Slide the DHS/DCS Direct Measuring Device (388.050) over the guide wire and determine the length (in this example 80 mm).



## 6

### Reaming

Adjust the reaming depth on the DCS Triple Reamer (338.460). The appropriate reaming depth is 10 mm shorter than the measured length of the guide wire (i.e. 80 mm – 10 mm = 70 mm).

Assemble the DCS triple reamer: Slide the DCS Reamer (338.470) over the Drill Bit  $\varnothing$  8.0 mm (338.100) until it clicks into place at the selected mark (in this example at 70 mm). Secure the reamer by tightening the Knurled Nut (338.120).

Ream down to the stop.

The appropriate DHS/DCS screw is 5 mm shorter than the reaming depth (in this example the DHS/DCS screw is 65 mm long).

Remove the DCS triple reamer.

**Note:** Check that "DCS" is marked on the reamer to avoid any mix-up with the DHS triple reamer.

### Option

If the bone is hard, tap the thread using the DHS/DCS Tap (338.170) and the short DHS/DCS Centering Sleeve (338.180). Tap the thread until the selected depth in the small window of the centering sleeve reaches the lateral cortex (in this example 70 mm).

**Note:** The tap may not be used in osteoporotic bone.

## 7

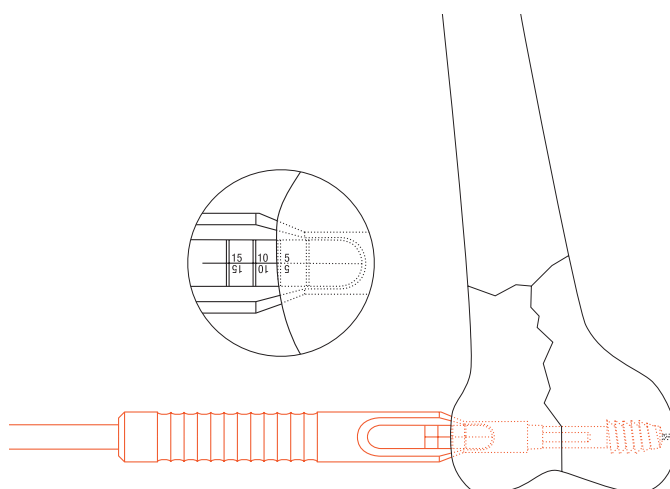
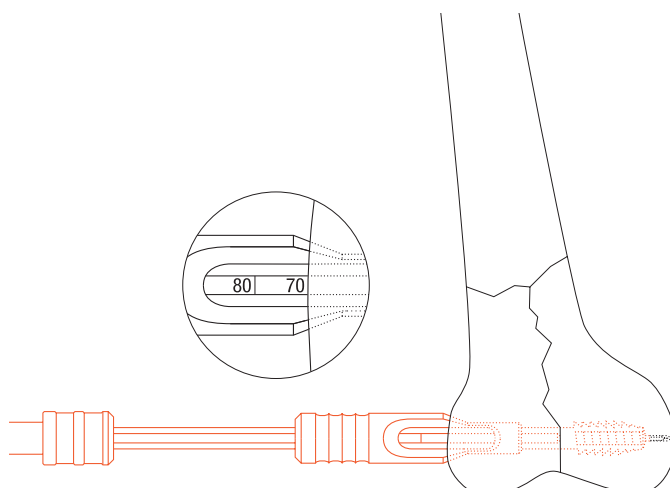
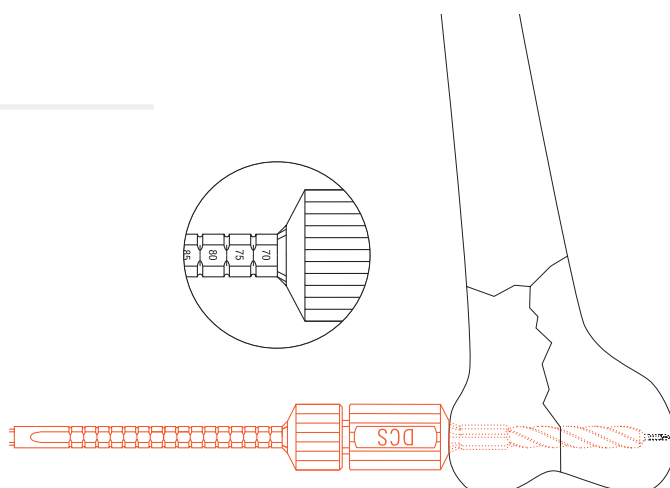
### Insert the DHS/DCS screw

Slide the insertion instruments (see page 17 for assembly) over the guide wire and advance the long Centering Sleeve (338.190) into the drilled hole. Insert the DHS/DCS screw until the 5 mm mark reaches the lateral cortex. In case of osteoporotic bone continue inserting the screw for a further 5 mm.

The handle of the DHS/DCS wrench must remain parallel to the femoral axis since only in this screw position can the DCS plate be positioned correctly over the flat-sided shaft of the DHS/DCS screw against the femoral shaft.

**Note:** Do not use the DHS/DCS wrench to reduce the fracture as this only allows limited transmission of forces.

Remove the DHS/DCS wrench and long centering sleeve.

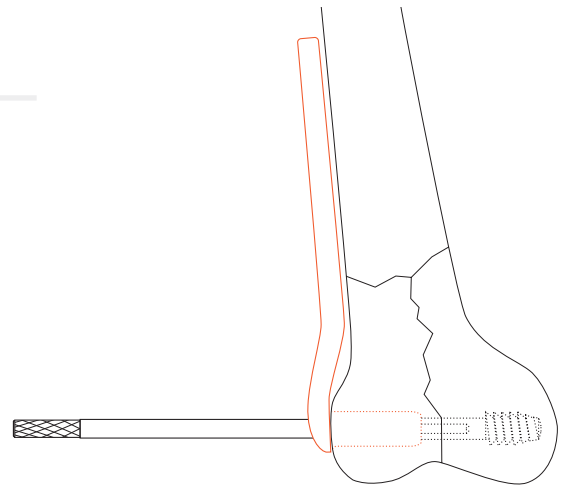


## 8

### Position DCS plate

Position the DCS plate over the connecting screw against the femoral shaft. Loosen the connecting screw and remove the Guide Shaft (338.210).

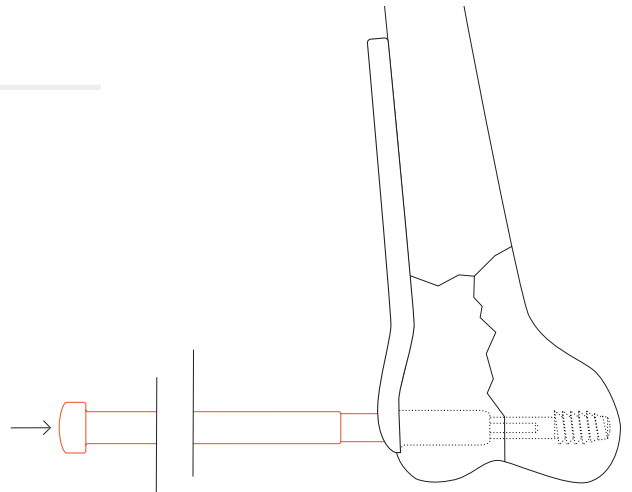
Set the drill to reverse operation to remove the guide wire. Dispose of the guide wire.



## 9

### Tap DCS plate

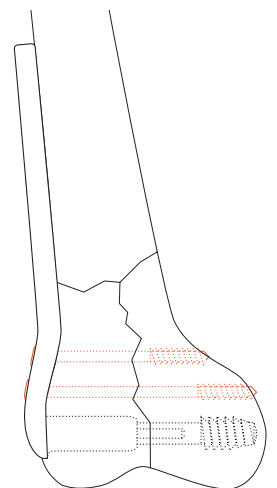
Tap the DCS plate into the predrilled channel using the DHS/DCS Impactor (388.140). Compress the fracture by gentle hammer taps against the impactor.



## 10

### Achieve compression using cancellous bone screws Ø 6.5 mm

Secure the two joint fragments of the Y-fracture by interfragmental fixation using two cancellous bone screws Ø 6.5 mm through the two distal plate holes (use the DCP Hip Drill Guide 4.5 [322.430], the Drill Bit Ø 3.2 mm [310.310] and the Tap [311.660] according to the standard technique).



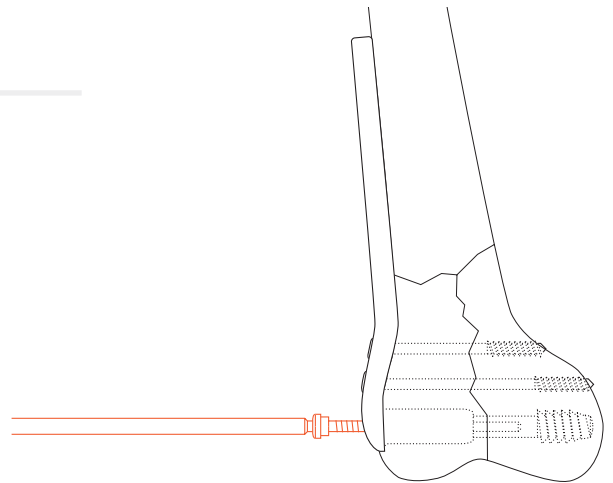
## 11

### Insert compression screw

In Y-fractures, compression must be achieved using the DHS/DCS Compression Screw (280.990).

First fix the plate to the femoral shaft with screws. Insert and tighten the compression screw.

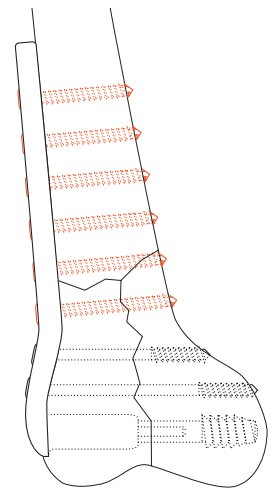
Particularly if the bone is osteoporotic, insert the compression screw carefully and ensure that the DHS/DCS screw thread is not stripped.



## 12

### Reduce metaphyseal fracture component

Reducing the shaft fragment against the DCS plate can achieve an anatomically correct reduction in respect of varus/valgus deviations. The length and rotation must be adapted by comparing the contralateral side.



## 13

### Fix DCS plate

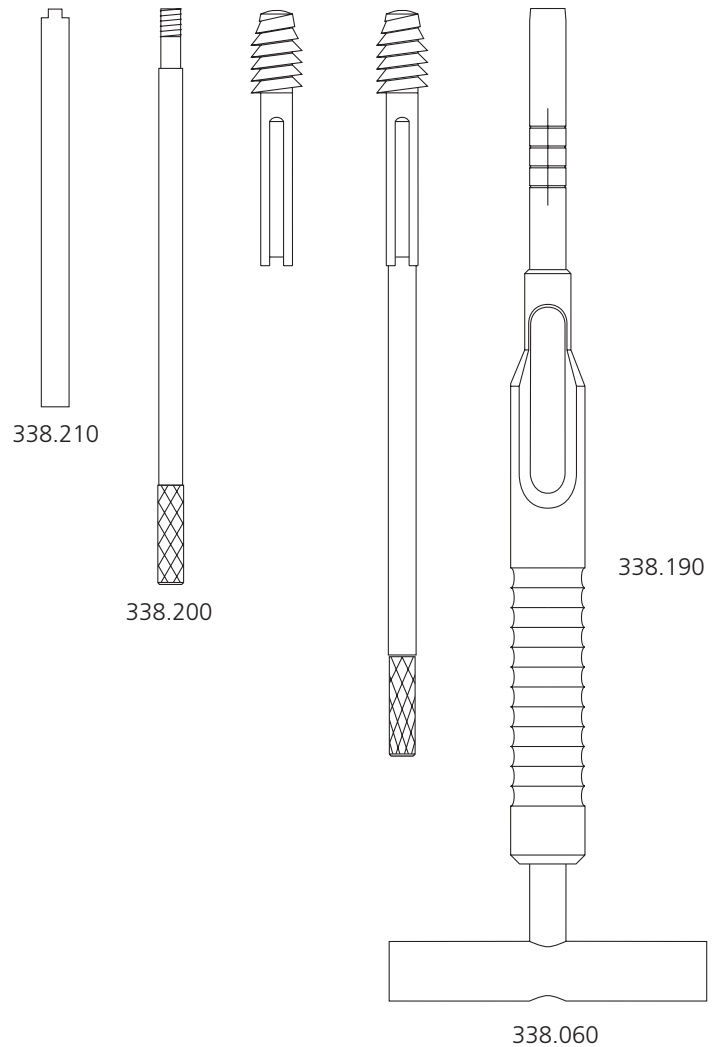
Using the DCP Hip Drill Guide 4.5 (322.430) and the Drill Bit  $\varnothing$  3.2 mm (310.310), drill neutral holes through the plate holes. Fix the DCS plate using cortex screws  $\varnothing$  4.5 mm of the appropriate length.

**Note:** With simple fractures, before fixing the plate, axial compression can be generated between the distal joint block and the shaft fragment using the Tension Device (321.120).

## Assembling the insertion instruments

Insert the short Connecting Screw (338.200) in the Guide Shaft (338.210) and screw into the inner thread of the DHS/DCS screw. The cam and slot must interlock correctly and firmly.

Slide the long Centering Sleeve (338.190) over the DHS/DCS Wrench (338.060). Insert the whole assembly into the DHS/DCS wrench.



## **Implant removal**

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First remove the DHS or DCS plate. Advance the DHS/DCS Wrench (338.060) over the DHS/DCS screw. The outer thread of the long Connecting Screw (338.220) must be securely held by the inner thread of the DHS/DCS screw. Undo the DHS/DCS screw while exerting axial traction.

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