Modern shaft concept for cemented anchoring

MS-30® Stem Cemented

Surgical Technique
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The philosophy of the MS-30 stem features a cemented anchorage. The three-dimensional tapered design without corners or edges maintains the strength of the cement mantle in the various Gruen zones. The geometry of the cement mantle is established during the preoperative planning.

The highly polished surface, together with the hollow space design of the distal centralizer, permits debonding in the uninterrupted cement mantle.

For good long-term results for cemented stems, particular attention should be paid to the cementing technique: Fundamental factors are insertion under pressure and ensuring a stable cement mantle particularly in the calcar region.

Different offset options allow the creation or restoration of normal anatomy and biomechanics. The standard version and the lateral version of the MS-30 stem allow the surgeon greater intraoperative flexibility.

With the MS-30 stem, one can choose the surgical technique of Professor Morscher for a lateral approach, or that of Professor Spotorno for a posterior approach.

Hip arthroplasties using the MS-30 stem have been carried out since 1990. The MS-30 stem with a mat surface was introduced on the market in 1992; in 1994, the MS-30 stem with a polished surface was launched internationally.

Since 1992, over 100,000 stems have been implanted worldwide with excellent ten-year results.

With these characteristics, the MS-30 stem fulfills the demanding requirements of modern endoprosthetics.

References:
Preoperative planning supports the work of the surgical team and allows the surgeon optimum preparation for the operation, as well as for the purpose of self-monitoring. The objectives of preoperative planning are to determine the stem size, the ideal anchorage of the stem in the medullary cavity, and the optimum position of the acetabular and femoral components for the restoration of leg length.

**Planning objectives**
- The choice and size of the implant
- Optimum cement mantle in the various Gruen zones
- Position and height of the resection of the neck of the femur
- The offset and, thus, the decision as to whether to use the standard or lateral version
- The choice of the corresponding prosthesis head
- The acetabulum, the establishment of the center of rotation, the size and the position of the acetabulum

**Determining leg length**

Three horizontal lines are drawn on the AP X-ray of the pelvis: the tangent of both ischia forms the base line.

A second line is drawn over the roofs of the acetabula, and the third between the lesser trochanters.

Using the ischiometer, the center of rotation on the side that is not to be operated on is established, and the distance to the teardrop figure is measured. Finally, the pelvic axis is drawn, running through the symphysis and perpendicular to the line.

The difference in the distances measured between the connecting line of the lesser trochanters and the baseline corresponds to the correction needed to obtain equal leg lengths.

**Same leg length**
All three lines run parallel.

**Dysmetry caused by the femur**
The first and second lines run parallel, whilst the bitrochanteric line is divergent towards the longer leg. The leg length difference determined on the X-ray must be compared with the difference that is established clinically.
Templates

The MS-30 templates serve as a planning aid. All sizes are clipped together to form one template set.

The essential planning information for implantation of the respective size can be found on a planning transparency: Here, the stem contours are shown with the resection line for both the standard and the lateral version of the MS-30. Also shown are the markings for the cement mantle and the respective distal centralizers for each stem size.

Dysmetry caused by the joint
The second and third lines run parallel, the first line deviates.

Combined dysmetry
All three lines are divergent.
Cement mantle

The optimum cement mantle for a highly polished stem without a collar is asymmetrical. It should be stronger or thicker in the area of primary transmission of load, i.e. in the calcar region (Gruen zone 7), as well as in the distal part of the prosthesis (zones 3 and 5). Cement mantle thicknesses greater than 7 mm should, however, be avoided, since these not only make pressurization more difficult, but they can also lead to bone necrosis as a result of an increasing in heat during polymerization of the cement. Rotational forces that encourage loosening are absorbed by the proximal “wing”, e.g. through sharp edges of the prosthesis.

In order to avoid metal/bone contact wherever possible, above all in the zones of higher stress 3, 5 and 7, a distal centralizer is an integral part of the MS-30 stem. Reaming of the medullary canal and using the distal centralizer and possibly the proximal positioner bring the stem into a neutral position.

The proximal positioner creates a cement mantle of at least 4 mm in Gruen zone 7: with the aid of the distal centralizer, a cement mantle of 2 mm is created in both, the a/p and the lateral/medial aspect.

Optimum positioning of the MS-30 stem in the various Gruen zones.
Planning steps in the case of unilateral coxarthrosis

1. Determine the possible difference in leg length, the prosthesis size and the position of the cup
The three horizontal lines, the pelvic longitudinal axis (in this example there is no dysmetry), the center of rotation (measured on the opposite, healthy hip) and the horizontal and vertical distance of the center from the base of the teardrop are drawn in. The template is then placed on top, with the limit of the acetabulum (ideally as a rule the subchondral bone layer), the height of the teardrop and the planned inclination of 40–45° being taken into account.

2. Trace the hemipelvis and the cup
Tracing paper is placed on the X-ray and the template, with the longitudinal axis parallel to the vertical pelvic axis. The hemipelvis and the cup implant are drawn in.
3. **Determine the size and position of the stem**

The appropriate template is placed on the femur. If possible, a space of 4–7 mm proximally (calcar) and 2 mm distally (tip of the prosthesis) should remain between the stem and the inner cortex layer in order to create an optimum cement thickness. This is the point at which the choice of prosthesis size and offset (standard or lateral version) is made. One of the four T-lines that run through the center of rotation should lie at the height of the greater trochanter. As a rule, the osteotomy level of the neck of the femur is 16–20 mm above the tip of the lesser trochanter.

4. **Pelvis level**

Without removing the femoral template, the tracing paper used in step 2 is placed in position, so that the inside of the cup corresponds to the mean neck length. The bitrochanteric and ischiatic lines must be parallel. If, in the case of residual dysmetry, the lines diverge and a leg lengthening is indicated, the following options are available: using a prosthesis head with a long neck, higher femur neck resection, or driving the tip of the prosthesis stem less deeply into the femoral canal.
5. Determine the size of the distal centralizer
When determining the optimum size of the two sketched centralizers on the template, one should select the one that ensures lateral cortical contact when the tip of the prosthesis is centered in the medullary cavity.

6. Result of preoperative planning
The femur, femoral stem, distal centralizer and medullary plug are drawn on the tracing paper. The medullary plug should be placed 1–2 cm below the tip of the centralizer. The extension of the lateral limit of the stem up to the greater trochanter is sketched in. This line determines the lateral limit of the cancellous bone to be removed in order to avoid positioning in a varus position.

The following dimensions are included in the drawing and measured:

- Lesser trochanter – osteotomy level
- Lesser trochanter – medial edge of the prosthesis neck
- Medullary plug – inner cortex layer of the osteotomy of the femur neck
- Connecting line between the center of rotation and the tip of the greater trochanter
Variants of the Surgical Technique

Surgical technique using a lateral approach, according to Professor E. W. Morscher

The medullary canal is prepared with rasps of ascending size. The last rasp to be used is always one size larger than the stem size that was determined in the preoperative planning. Through this, sufficient space is created for an uninterrupted circumferential cement mantle. The rasp also serves as a test prosthesis: The modular handle of the rasp is removed and a corresponding test head is mounted. After trial reduction, the test head and the rasp are removed, the medullary plug is inserted and the medullary canal is filled with cement, under pressure.

A MS-30 stem one size smaller than the last rasp used is inserted.

Surgical technique using a posterior approach, according to Professor L. Spotorno

The medullary canal is prepared with rasps of ascending size. The last rasp to be used, which is driven in as far as the osteotomy level, corresponds to the stem size that was determined in the preoperative planning. The rasp handle is then removed and the test head is placed on the cone of the modular rasp. After trial reduction, the test head is removed and the rasp is driven in deeper, up to the second marking.

The Spotorno technique creates space for the cement mantle in that the rasp is driven in deeper after trial reduction.
1. Patient in dorsal position, pelvis elevated with a flat cushion. Skin incision extends laterally starting 4 cm above the tip of greater trochanter extending distally along the femoral shaft.

2. Separation of the fascia lata is performed. Incision and longitudinal separating of the gluteus medius and the vastus lateralis muscles on the latero-ventral circumference of the greater trochanter. The incision is extended proximally in the direction of the fibers of the tendon and dissect by bluntly pulling apart the muscle fibers of the gluteus medius muscle.

3. Preparation of the front wall of the capsule and insertion of a Hohmann lever at the front rim of the acetabulum. Scalpel detachment of the fibers attached to the capsule from the gluteus minimus muscle cranially and the vastus intermedius muscle distally. Insertion of a Hohmann lever respectively at the cranial and at the caudal circumference of the neck of the femur. After insertion or adjustment of the Hohmann lever at the rim of the acetabulum, the utmost care must be taken that the tip of the lever does not lie in the muscle tissue or tendinous tissue, but under it (femoral artery, vein, nerve!). The joint capsule is then incised longitudinally on the ventral circumference, and removed ventro-cranially and ventro-caudally through H-shaped extensions of the incision. The cranial and caudal Hohmann levers are moved to intra-articular positions.

**Lateral Approach**

Surgical technique according to Professor E. W. Morscher
4. An osteotomy of the femoral neck is performed at an angle of 30° with the leg in external rotation.

5. Using the osteotome, the femur head is mobilized in the osteotomy and is extracted with the femoral head extractor (REF 75.00.21).

6. The joint capsule is detached from the psoas tendon. Insertion of a Hohmann lever under the ventro-caudal rim of the acetabulum or under the caudal acetabular rim osteophytes. Implantation of the cup.

7. The leg is adducted and externally rotated.

8. The Hohmann lever that was inserted at the start of the operation in the front of the pubic ramus remains in this position throughout the entire procedure. Where necessary, dorsal capsule excision is completed with the leg externals rotation.
9. An important step is the resection of the cranio-lateral base of the femoral neck, in order to gain lateral space. Through this, insertion of the rasp and the prosthesis in a varus position is avoided.

10. The level of the osteotome neck is assessed by measuring the distance between the tip of the lesser trochanter and the medio-dorsal resection edge of the femoral neck (Ruler, REF 95.00.03). Further resection of the femoral neck may be necessary.

11. A long curette is inserted into the medullary cavity (REF 75.13.33), in order to correctly establish the rasp direction in a neutral axis. The complete removal of all cancellous bone on the inner side of the medial femoral neck base using a bone curette is very important.

12. Opening of the medullary cavity with the straight awl with T-handle, in order to ensure neutral positioning of the femoral shaft.
13. Insertion of the smallest rasp (no. 6), already taking account of the desired antetorsion (as a rule, 10–15°). Checking the resection level, which should lie at a right angle to the rasp adapter.

14. This is followed by the step-wise expansion of the medullary space using larger rasps. Torsional movements must be avoided while impacting the rasps. The largest rasp is impacted as far as the marking that corresponds to the osteotomy level. The modular rasp simultaneously serves as a test prosthesis.

15. After the modular rasp adapter has been removed, the appropriate trial head is mounted. If the plan is to use the lateral version of the MS-30 prosthesis, the eccentric test head is used. It is important that the eccentric test head is placed so that it enlarges the offset of the stem. In order to facilitate correct positioning, the test head is marked «cranial».

16. Trial reduction: The height from the tip of the lesser trochanter to the center of rotation of the femoral head is checked. The risk of dislocation is checked by inward and outward rotational movements in flexion and extension. At the same time, the head containment is verified. The position of the psoas tendon is checked. Under no circumstances may this rub on the rim of the artificial cup.
17. The leg lengths are checked.

18. On the MS-30 prosthesis to be implanted, measure is taken with the introducing rod for the position of the medullary plug, measured from the shoulder of the prosthesis. With regard to the depth of deployment, it must be noted that the distal centralizer must be mounted on the stem, and the distance between the tip of the centralizer and the medullary plug must be approximately 1–1.5 cm.
At the same time, the size of the centralizer is established. If the plug of the next size after the stem size fits, the distal centralizer with the corresponding number is used. Experience shows that this is the right combination. In the case of larger medullary spaces, the second number of the distal centralizer is used.
Thus, for a size 10 stem and a medullary cavity into which the plug 12 fits, a distal centralizer of size 10/12 should be used. In the case of a wider medullary canal, size 10/14 is used.

19. The trial rasp is removed. The femoral medullary cavity is rinsed, and the diameter of the medullary space is checked.

20. The medullary plug is inserted.
21. Rinse and dry the medullary canal.

22. Insert of the drain.

23. The appropriate distal centralizer is assembled to the prosthesis. The distal centralizer comprises four wings, one of which is longer than the others. The longer wing must be positioned on the lateral side of the stem.

24. The proximal positioner is mounted. First of all, this is inserted into the extraction hole and only then it is brought to its final position. It is not mandatory to use the proximal positioner. However, it facilitates the generation of the optimum cement mantle thickness.
25. The bone cement is introduced slowly under maximum pressure. The cement is introduced antegrade, using a drain and a silicon disk for the compression. Alternatively, the cement is pressed in retrograde. This procedure requires neither a compression disk nor a drain. The planned proximal and distal cement thickness is achieved by implanting a prosthesis that is one size smaller than the final rasp.

26. With the setting device or impactor, the MS-30 stem is inserted. Particular care must be taken to ensure that medially on the femur neck (calcar), between the cortex layer and the stem, there is a cement layer of 4 – 7 mm thickness.

27. Until the cement has completely cured, the pressure with the impactor must be maintained. Immediately before final polymerization, the stem should not be impacted any further in order to prevent fractures of the cement mantle. As soon as the cement has hardened, all three legs of the proximal positioner are cut off using the scalpel or Luer’s pliers (REF 100.01.840).
28. Excess cement is carefully removed.

29. The head is mounted using a rotational movement, and is locked through a light hammer blow on the repositioning lever.

30. Reduction of the prosthesis. Intra-articular insertion of a Redon drain.

31. Reinsertion of the longitudinally separated tendon of the gluteus medius muscle, including that of the gluteus minimus muscle and the vastus lateralis muscle, with strong, non-absorbable thread.
Closure of the incision on the anterolateral circumference, using individual over-and-over sutures. Insertion of a Redon drain subfascially, and closure of the iliobibial tract.
Insertion of a subcutaneous Redon drain, subcutaneous sutures, skin sutures.
**Posterior Approach**

Surgical technique according to Professor L. Spotorno

1. Patient in a strict lateral position. Posterolateral incision according to Austin Moore.

2. Incision of the fascia lata and partial notching of the femoral insertion of gluteus maximus muscle. Insertion of a Hohmann lever under the gluteus medius muscle on a level with the femoral neck. Exposure and division of the outer rotators and of the dorsal articular capsule.

3. Dislocation of the hip by a combined movement with inward rotation, flexion and adduction. Resection of the residual capsule and osteotomy of the femoral neck after measuring the level in accordance with the preoperative plan. The resection level starts about 15–20 mm proximally of the lesser trochanter (running obliquely, with a 30° inclination).

4. Removal of the head and neck of the femur, insertion of a Hohmann lever and exposure of the acetabulum.

5. Implantation of the selected cup.
6. Using the boxed chisel, the trapezoidal segment of the cancellous bone is removed from the bulb as far as the lateral limit, in accordance with the preoperative planning. This permits correct insertion of the rasp, avoiding a varus position.

7. Opening of the medullary cavity using the awl, and removal of the cancellous bone.

8. The first rasp is impacted, starting with the smallest size, and already taking account of the desired antetorsion of 10–15°.

9. The final rasp is impacted up to the osteotomy level.
10. The modular rasp simultaneously serves as a test prosthesis. Determination of the correct depth of impaction (distance between the lesser trochanter and the medial edge of the prosthesis neck as planned preoperatively), and of the correct positioning.

11. Mounting of the test head, trial reduction and assessment of leg length, muscle tension, stability and extent of movement. If the plan is to use the lateral version of the MS-30 prosthesis, the eccentric test head for the MS-30 is used. It is important that the eccentric test head is placed so that it enlarges the offset of the stem. In order to facilitate correct positioning, the test head is marked “cranial” (if the test head is wrongly placed in the opposite direction (180°), the result is a reduced offset, this means a medialization).

12. Removal of the test head and deeper impaction of the rasp until the second marking. The additional space that is generated by deeper impaction produces proximally a cement mantle thickness of at least 4 mm for the proximal positioner.

13. In the case of inadequate bone quality, the isthmus and the adjacent cancellous bone are removed with a curette.
14. On the MS-30 prosthesis to be implanted, measure is taken with the introducing rod for the position of the medullary plug, measured from the shoulder of the prosthesis. With regard to the depth of deployment, it must be noted that the distal centralizer must be mounted on the stem, and the distance between the tip of the centralizer and the medullary plug must be approximately 1–1.5 cm.

At the same time, the size of the centralizer is established. If the plug of the next size after the stem size fits, the distal centralizer with the corresponding number is used. Experience shows that this is the right combination. In the case of larger medullary spaces, the second number of the distal centralizer is used. Thus, for a size 10 stem and a medullary cavity into which the plug 12 fits, a distal centralizer of size 10/12 should be used. In the case of a wider medullary canal, size 10/14 is used.

15. Insertion of the introducing rod with plug to determine the size of the distal centralizer and of the medullary plug (the likely size has already been determined in the course of preoperative planning).

16. Insertion of the medullary plug.
17. The medullary canal is rinsed and a hemostatic tamponade is inserted. This is removed and a drain is inserted.

18. The centralizer is mounted on the prosthesis, in accordance with the planned size or the size determined using the introducing rod with plug. The centralizer must be carefully pushed onto the stem tip until it sits securely there. The distal centralizer comprises four wings, one of which is longer than the others. As the stem tip is not symmetrically round, the centralizer has been designed to fit exactly. The longer wing must be positioned on the lateral side of the stem.

19. The proximal positioner is mounted. First of all, this is inserted into the extraction hole and only then is it brought into its final position. It is not mandatory to use the proximal positioner. However, it facilitates the generation of the optimum cement mantle thickness. It is particularly recommended in the case of a steep femoral neck, where there is more likely to be a risk of a too thin cement mantle in zone 7, as well as a risk of direct bone/metal contact.

20. The bone cement is pressed in using maximum pressure. The cement is introduced antegrade, using a drain and a silicon disk for compression. Alternatively, the cement can be pressed in retrograde. This procedure requires neither a compression disk nor a drain.
21. Insertion of the MS-30 stem with the distal centralizer and the proximal positioner.

22. With the setting device, the stem is pushed in a distal-lateral direction, in order to avoid a varus position.

23. When the proximal centralizer is used, particular care must be taken that the stem is somewhat lateral and is not inserted too late in the polymerization process. This procedure encourages the formation of a cement mantle with sufficient medial thickness.

In order to achieve this, the impactor is aligned obliquely in a lateral direction, and not strictly axially, during insertion. Until the cement has completely hardened, the pressure must be maintained with the impactor. Immediately before final polymerization, the prosthesis must under no circumstances be impacted further, due to the risk of the cement mantle breaking. As soon as the cement has hardened, all three legs of the proximal positioner are removed using a scalpel or Luer's pliers.
24. The cement is carefully removed as far as the lower web of the proximal element, i.e. as far as the resection level.

25. After careful cleaning of the cone, the prosthesis head is mounted using a rotational movement.

26. The head is locked on the cone through a light hammer blow on the repositioning lever.

27. Reduction and function check.

28. Redon drainage and closure of the wound.
Case Study by Professor E. W. Morscher

63-year-old female patient with marked coxarthrosis
Implantation of a MS-30 stem and a Morscher Press-Fit™ Cup. At the time of the ten-year follow-up, the patient had no problems. The clinical evaluation showed excellent mobility of the hip joint.
Case Study by Professor L. Spotorno

Primary osteoarthrosis in a 68-year-old female patient
The one-month post-operative X-ray demonstrates excellent biomechanical reconstruction of the hip, with a perfectly cemented MS-30 stem in combination with a Wagner Standard Cup. The X-ray taken at the follow-up examination 12 years later is impressive: it shows no change over this period. From a clinical point of view, there is neither restriction with regard to ability to walk, nor limping or pain in this 80-year-old patient.
### Implants

**MS-30® Schaft, Standard**

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**MS-30® Stem, standard**

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**Protasul® S30**

**Cemented**

**E. Morscher/L. Spotorno**

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**Protasul® S30**

**Cemented**

**E. Morscher/L. Spotorno**

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**Proximales Positionierelement**

**Proximal positioner**

**Elément de positionnement proximal**

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**Distales Zentrierelement**

**Distal centralizer**

**Centralisateur distal**

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**Lateral**

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* U.S. Patent No. 6, 669, 734
** U.S. Patent No. 6, 342, 077
Instrumentation

**MS-30® Kunststoffsieb (komplett)**
- MS-30® plastic tray (compleet)
- Plateau MS-30® en plastique (complet)
  - REF: 99.27.00-00

**MS-30® Kunststoffsieb (leer)**
- MS-30® plastic tray (empty)
- Plateau MS-30® en plastique (vide)
  - REF: 01.00359.100

**Einsatz für MS-30® Kunststoffsieb**
- Insert for MS-30® plastic tray (empty)
  - Insert pour plateau MS-30® en plastique (vide)
  - REF: 01.00359.200

**Deckel für MS-30® Kunststoffsieb**
- Cover for MS-30® plastic tray
  - Couvercle pour plateau MS-30® en plastique
  - REF: 01.00029.029

**Abgekröpfter Hohlmeissel**
- Double-curved gouge
  - Ciseau-gouge à double courbure
  - Grösse/Size/Taille: 9 mm
  - REF: 75.09.15

**Handgriff mit Schnellkupplung**
- Handle with quick coupling
  - Poignée à verrouillage rapide
  - REF: 75.00.25

**Raspel MS-30®, modular**
- Rasp MS-30®, modular
  - Râpe MS-30®, modulaire
  - Size
  - REF
  - 6: 72.13.94-060
  - 8: 72.13.94-080
  - 10: 72.13.94-100
  - 12: 72.13.94-120
  - 14: 72.13.94-140
  - 16: 72.13.94-160
  - 18: 72.13.94-180

**Testkopf für HTP, Konus 12/14**
- Test head for THR, cone 12/14
  - Tête d’essai pour PTH, cône 12/14
  - Grösse/Size/Taille ø mm
  - REF
  - S: 8: 01.01559.128
  - M: 8: 01.01559.228
  - L: 8: 01.01559.328
  - XL: 28: 01.01559.428

**Reponieraufsatz**
- Repositioning top
  - Calotte de réduction
  - ø mm REF
  - 28: 78.00.38-28

**Griff zu modularen Raspen**
- Handle for modular rasps
  - Poignée pour râpes modulaires
  - REF: 70.00.94

**Langer Querstab**
- Long bar
  - Barre longue
  - REF: 70.00.01

**Exzentrischer Testkopf für lateralen Schaft MS-30®**
- Eccentric test head for MS-30® lateral
  - Tête d’essai excentrique pour MS-30® latéral
  - Grösse/Size/Taille ø mm
  - REF
  - S: 28: 01.00359.128
  - M: 28: 01.00359.228
  - L: 28: 01.00359.328
  - XL: 28: 01.00359.428

**Repositioning top**
- Repositioning top
  - Calotte de réduction
  - ø mm REF
  - 28: 78.00.38-28
Messdorn zu Markraumstössel
Plug for introducing rod
Mandrin de mesure pour pousseur pour cavité médullaire

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Setzinstrument MS-30®
Setting device MS-30®
Instrument de pose MS-30®

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Ein-/Ausschläger
Impactor/extractor
Impacteur/extracteur

Ausschlaginstrument
Extraction instrument
Instrument d'extraction

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Reponierhebel
Repositioning lever
Lever de réduction

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Kunststoffaufsatz
Synthetic top
Calotte synthétique

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Zementstössel, klein
Cement pusher, small
Pousseur pour ciment, petit

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**Führungsinstrument MS-30®**
Guiding device MS-30®
Instrument de guidage MS-30®

**Handgriff**
Handle
Poignée

**Gewindestange**
Threaded rod
Tige filetée

**Standardverriegelungsstück**
Standard bolt
Pièce de verrouillage standard

**Laterales Verriegelungsstück**
Lateral bolt
Pièce de verrouillage latérale

**Zielgerät**
Positioning guide
Guide de positionnement

---

**Inbusschlüssel (für Messdorn)**
Allen key (for introducing plug)
Clé inbus (pour mandrin de mesure)

**Reponieraufsatz**
Repositioning top
Calotte de réduction

**Testkopf für HTP, Konus 12/14**
Trial head for THR, cone 12/14
Tête d’essai pour PTH, cône 12/14

**Adapter**
Adapter
Adaptateur

**Kastenmeißel**
Boxed chisel

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**Auf Anfrage**
On request
Sur demande

---

**Größe/Size/Taille ø mm**

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**Exzentrischer Testkopf für lateralen Schacht MS-30®**
Eccentric test head for MS-30® lateral
Tête d’essai excentrique pour MS-30® latéral

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