

# MUTARS<sup>®</sup>

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implantcast



**Humerus Inverse**  
Surgical Technique





# Humerus Inverse Surgical Technique

MUTARS® was developed in co-operation with Univ.-Prof. Dr. W. Winkelmann (ex-director) and Univ.-Prof. Dr. G. Gosheger (director) Department of General Orthopaedics and Orthopaedic Oncology at the University Hospital of Münster, Germany. MUTARS® is in successful clinical use since 1992.

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**Nota Bene:** The herein described surgical technique shows the treatment suggested by the author in uncomplicated surgical procedures. However, it is ultimately the operating surgeon's decision, which approach is the most reasonable and effective for the respective patient.

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## The Silver Coating

Infections represent the most severe complications of tumour arthroplastic treatments. Although local and systemic antibiotic treatments are considered, the scientific literature reports of infection rates from 5 to 35 percent [1]. Reasons for these high rates are, for example, the long surgery time, the large incisions and the immunosuppression due to chemo therapy and radio therapy as well as the increasing resistance of the bacteria against antibiotic drugs.

Silver, in particular free silver ions, is well known for its broad-spectrum antimicrobial activity. The silver coating has been shown to reduce bacterial colonization on the device surface.

Until now only non-articulating surfaces and surfaces without direct bony contact are coated with silver.

In the catalogue information of this surgical technique you can find the supplement \*S indicating which MUTARS® components are available in a silver coated version. The eight digit REF number receives an addition after the last digit (e.g. 5220-0020S).

## Important Intra-Operative Instructions for the Use of Silver-Coated Implants

It is not permitted to flush the wound with antiseptics that contain H<sub>2</sub>O<sub>2</sub>, Iodine or heavy metals (such as Betaisodona®) and acetic acid during surgery since this can lead to a subsequent loss of effectiveness of the silver coating due to their oxidative properties. Alternatively, solutions such as NaCl or Lavasept® and Prontosan® can be used. The additional use of antibiotic-containing bone cement can be an advantage particular in case of a septic revision.

## The TiN Coating for Allergy Prophylaxis

All metallic implant components release ions to their environment over time. In some patients such ions can elicit allergic reactions. Nickel, cobalt and chromium, which are elements of the base material CoCrMo of the articulating implant components, are considered the most frequently allergy eliciting metals [2] The TiN-coating is biocompatible and acts like a barrier; the potential release of allergy eliciting ions of the base material is reduced to a minimum [3]. Also in clinical practice there have never been any evidence of allergic reactions with implants that have been TiN-coated showing an intact surface [5]. Therefore the TiN-coating on implant components is especially suitable for patients with sensitivity to nickel, chromium or cobalt [4][5].

Since almost all components of the MUTARS® tumour system consist of titanium alloy, this only concerns those components, which are made of a CoCrMo alloy. The REF-numbers of the TiN-coated implants have the suffix N after the last digit (e.g. 5720-0005N). Items which are available with Silver and TiN coating have the suffix SN after the last digit (e.g. 5720-0005SN).

**\*S:** Implants are available with Silver coating!

**\*N:** Implants are available with TiN coating!

**\*SN:** Implants are available with Silver and TiN coating!

[1] Gosheger et al. 2004. Silver-coated megaendoprostheses in a rabbit model – an analysis of the infection rate and toxicological side effects. *Biomaterials* 25, 5547-5556.

[2] Eben R et al. (2009) Implantatallergieregister - ein erster Erfahrungsbericht. *Orthopäde* 38: 557-562

[3] Wisbey et al. (1987) Application of PVD TiN coating to Co-Cr-Mo based surgical implants. *Biomaterials*, 11

[4] Prof. Thomas LMU München Final Report Effect of a TiNbN or TiN surface coating on cobaltchromium- molybdenum and stainless steel test specimens regarding the release of nickel, chromium and cobalt: evaluation via eluate analysis and in-vitro cytokine release from peripheral human blood cells, Data on file

[5] Baumann A. (2001) Keramische Beschichtungen in der KTEP Standardlösung für Allergiker. *JATROS Orthopädie & Rheumatologie* 6: 16-17

# MUTARS® Humerus Inverse

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## Pre-Operative Planning

Pre-operative planning and precise surgical techniques are mandatory for optimal results. The instructions and the procedure given in the surgical technique to the system must be adhered to. Familiarity with the recommended surgical technique and its careful application is essential to achieve the best possible outcome.

Before surgery a surgical planning with regard to the dimensions of the prosthetic model and the positioning of the implant components in the bone has to be carried out by the surgeon.

For this purpose, x-ray templates are available:

**Digital templates:** Digital templates are included in the data base of the common planning systems. For missing templates, please contact the provider of the planning software and request for these templates.

**Radiographic templates:** Alternatively radiographic templates are available in various scale factors, which can be obtained from your local representative.



Picture shown: MUTARS® Humerus inverse implant in A/P view

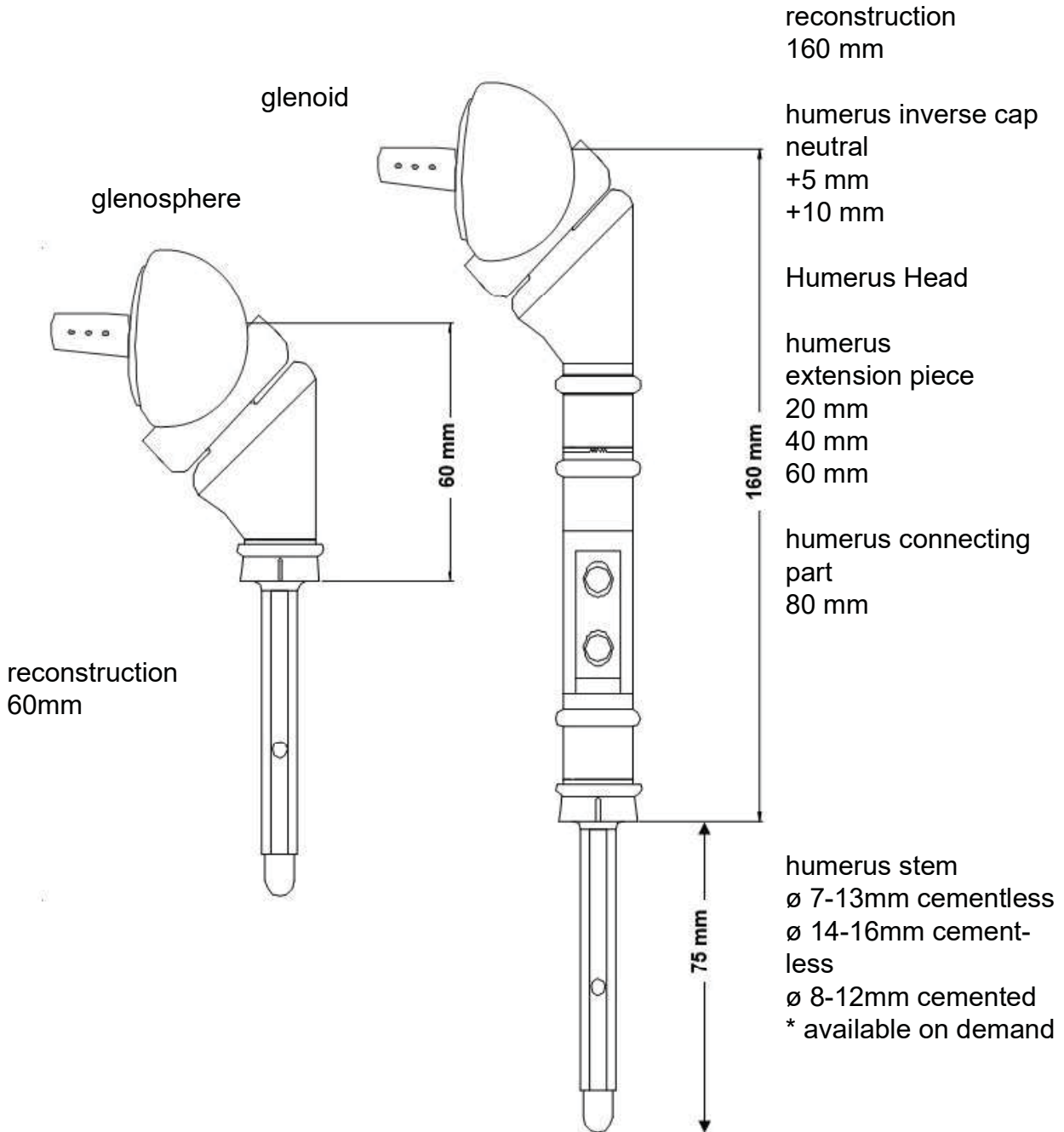


Picture shown: MUTARS® Humerus inverse implant in M/L view



# MUTARS® Humerus Inverse

## System Overview





# MUTARS® Humerus Inverse

## Assembling Options

by using a MUTARS® humerus inverse cap (length in mm)

Components			
Reconstruction (mm)	Head (mm)	Extension piece / connecting part 80 mm (mm)	Screw (mm)
60	50	-	15
80	50	20	35
100	50	40	55
120	50	60	75
140	50	80	15 + 15
160	50	20 + 80	35 + 15
180	50	40 + 80	55 + 15
200	50	60 + 80	75 + 15
220	50	60 + 80 + 20	75 + 35
240	50	60 + 80 + 40	75 + 55
260	50	60 + 80 + 40 + 20	75 + 75

**Note:** Please notice that the amount of implants and instruments send with an individual shipment may differ from the information in the catalogue information of this brochure. Please make sure, during the preoperatively planning, that all necessary implants and instruments are available for the surgery.

## Surgical Technique

### Tumour Resection

Resect the tumour and measure the length of the explant and determine the length of the explant. The minimum bone resection is 60mm.

### Preparation of the Glenoid

Place the glenoid drill guide and choose the correct position for the glenoid implant. Drill the central hole with the 3.2mm pin and leave in the pin (Fig. 1). Alternatively, the drill guide (Fig. 2) can be used. Drill approximately 2.5cm deep. Prevent from drilling too deeply as the drill has no stop.

In order to expose the subchondral bone, ream the glenoid bone with the glenoid reamer guided by the 3.2mm central pin. The reamer is guided by the central peg (Fig. 3 and Fig. 4).

Leave the pin inside the bone. The best fixation is achieved when the bleeding subchondral bone is reached (Fig. 5).

**Note:** The central peg hole is slightly smaller than the central peg of the implant. The central peg will lock by PressFit eventually.



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



## MUTARS<sup>®</sup> Humerus Inverse



Fig. 6



Fig. 7

Screw the humerus impactor to the glenoid implant. Make sure that the cranial marking is orientated correctly. Impact the implant with cautious beats into the bone until the glenoid lies completely flush on the reamed bone surface. Make sure that the "cranial" marking is properly placed (Fig. 6 and Fig. 7) and remove the impactor afterwards.

The drilling angle can be chosen freely between 0° and 15°.

### Optional Surgical Technique

In order to position the screws in 15° precisely, use the special glenoid drill guide correctly orientated, so the cranial and caudal position is found. Use the 2.0mm drill and the drill guide to pre-drill for the additional cancellous screws (Fig. 8).

The glenoid drill guide allows only to drill through the cranial and caudal hole in an angle of 15°. The pre-drilled threads in the glenoid implant allow only to position the cranial and caudal screws 15° angled.

Use the 2.0mm drill to predrill the screw holes for the additional fixation screws (Fig. 8).



Fig. 8



Fig. 9

Measure the screw length with the depth guide (Fig. 9).



Insert the 4:2MM angle stable screws with the 2.5mm hexagon screwdriver until the screw head is fully flat with the surface of the metal glenoid implant (Fig. 10).



Fig. 10

### Impaction of the Glenosphere

Seat the glenosphere to the glenoid implant. The lip of the glenosphere will lock onto the outer locking rim of the glenoid implant (Fig. 11).



Fig. 11

Enhance the locking by the use of the head impactor (Fig. 12).



Fig. 12

Make sure that the glenosphere is fully seated onto the glenoid metal implant (Fig. 13).



Fig. 13

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## Humeral Bone Preparation

Ream the medullary cavity with the medullary cavity reamer (Fig. 14).



**Fig. 14**

## Cementless Use

Drill the medullary cavity with a humerus drill 1 mm smaller than the size of the preoperatively chosen humerus stem (Fig. 15).

Make sure that at least 4cm of cortical bone contact is available.

## Cemented Use

Drill the medullary cavity with a humerus drill 2 mm larger than the size of the preoperatively chosen humerus stem (Fig. 15).



**Fig. 15**

## Rasping of the Humeral Cavity

Assemble the humeral rasp of the appropriated size (see tables below), the extractor device, the humerus impactor and the sleeve. Lock the rasp on the humerus impactor by using the counter wrench.

**Remark:** The use of a humeral rasp for a cemented stem is optional. Generally you can proceed with the trial assembly.

## Use of Cementless Stems

Use the humeral rasp (Fig. 16), of the same size as the preoperatively chosen humerus stem (table 1).

Stem size	Rasp size
9 mm	9 mm
10 mm	10 mm
11 mm	11 mm
12 mm	12 mm
13 mm	13 mm

**Table 1**

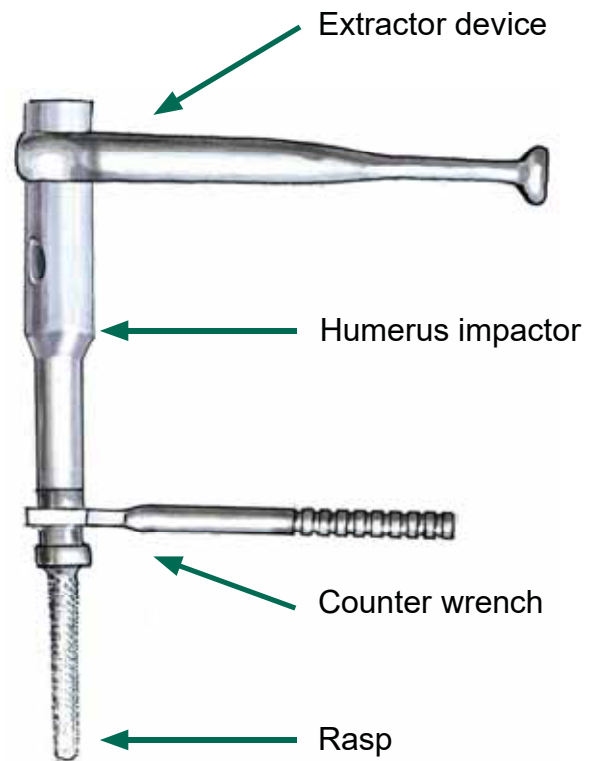
## Optional Technique for the Use of Cemented Stems

If you want to prepare for a cemented stem with the humeral rasp, please use the rasp which is 2 mm larger than the preoperatively chosen cemented humerus stem (Fig. 16).

That will provide a cement mantle of 1mm thickness (table 2).

Stem size	Rasp size
8 mm	10 mm
9 mm	11 mm
10 mm	12 mm
11 mm	13 mm
12 mm	14 mm

**Table 2**



**Fig. 16**

## MUTARS® Humerus Inverse



Fig. 17

Rasp the medullary cavity with the chosen humeral rasp (Fig. 17 and Fig. 18). A carefully use of the mallet is recommended.

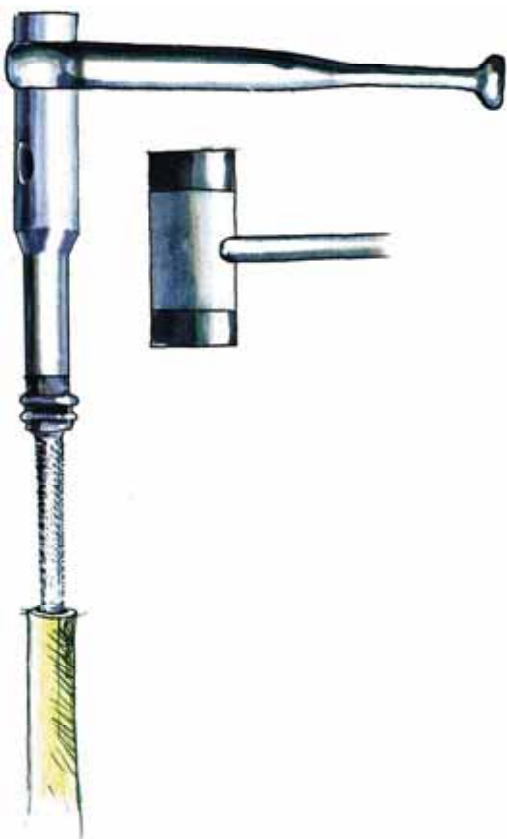


Fig. 18

**Remark:** It is recommended to clean the rasp from bone chips during the rasping.  
To prevent fractures of the cortical bone, it is helpful to fix a bone forceps around the humeral bone during rasping.

Leave the humeral rasp in the bone for the trialing.

## Trial Reduction With the Trial Components

Mount the trial humerus head and the possibly used trial extension pieces (possible enlargement from 20 to 200 mm; see „Assembling Options“ auf Seite 5) onto the top of the rasp (Fig. 19).

Please insert the trial screw of the appropriate length and tighten the screw with the socket wrench (Fig. 20).

**Remark:** Please, keep in mind that no humerus trial stems are available. If you have not opted for the rasping option when implanting cemented stems, the only way to trial will be with the original cemented stem without cementing it.



**Fig. 19**



**Fig. 20**

Put the inverse humerus trial cap on the head (fig. 16). There are caps in sizes of neutral, +5 mm, +10 mm available.

Perform a trial reduction and control the muscle tension and the range of motion. In case of instability change the trial cap accordingly.

If a sufficient function is achieved please remove all trial components.



**Fig. 21**

## MUTARS® Humerus Inverse

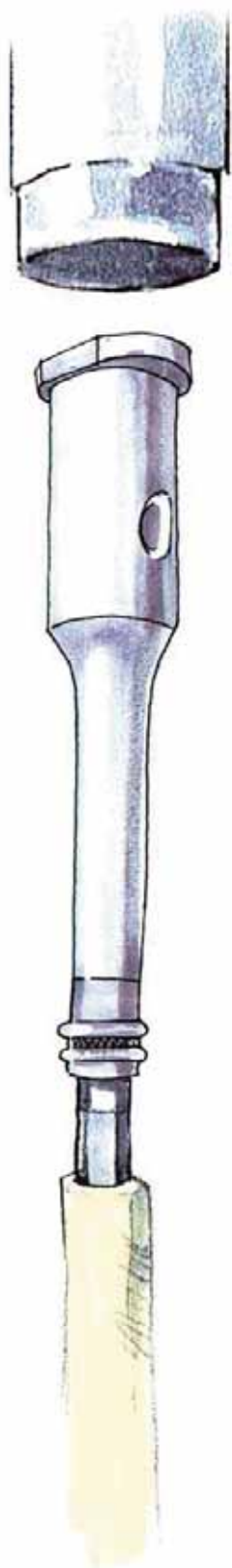


Fig. 22

### Implantation of the Humeral Stem

Mount the humerus stem of the proper size, the impact sleeve on the impactor.

Fasten the connection using the counter instrument. Impact the humerus stem (Fig. 22).

When using the cementless stem, insert the stem of the same size as the previously used rasp.

**Remark:** To prevent fractures of the cortical bone, it is helpful to fix a bone forceps around the humeral bone during impactation.

It is possible to protect the humerus stem against rotation using a 3.5mm cortical screw.

If a cemented implantation is planned, insert the cement and use the cemented stem which is 2 mm smaller than the previously used drill or rasp.

Remove all instruments, especially during the cement hardening to prevent bending moments.



## Final Assembly

Combine the proximal implant components on the humeral stem and lock the components in the correct rotational alignment. Fasten the screw of the bar screw of correct length (see „Assembling Options“ auf Seite 5). Use the socket wrench small and secure the composition with the counter instrument (Fig. 23). Lock the humerus safety screw in the same way (Fig. 24)

Screw the humerus inverse cap of the correct size on the humeral head. Tighten the humerus inverse cap with the wrench for cap/counter instrument and secure it with the wrench for humerus (Fig. 26).

Reduce the shoulder joint and check the joint stability and the range of motion (fig. 20).



Fig. 23



Fig. 24



Fig. 27



Fig. 25



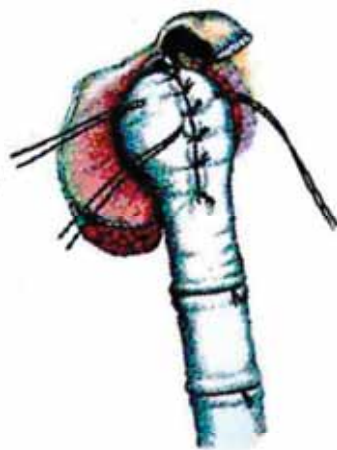
Fig. 26



# MUTARS<sup>®</sup> Humerus Inverse



**Fig. 28**



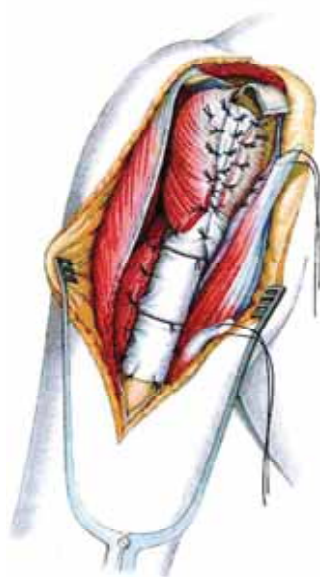
**Fig. 29**

## The Use of the Attachment Tube

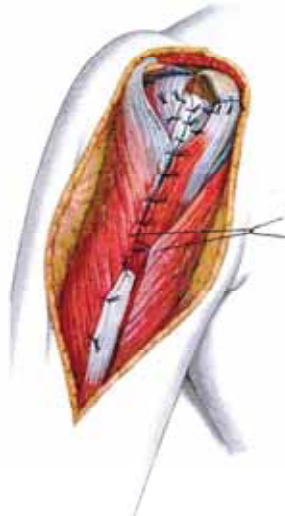
Fasten the attachment tube with 4 ethibond (thread size 2) or similar non-resorbable suture material to the remaining joint capsule / rotator cuff.

Fix the tube proximal first than distal.  
Pull the tube over the joint capsule and fix the tube to the capsule wall.

Afterwards tighten the tube and fix it over and under the pads of the MUTARS<sup>®</sup> components (Fig. 28 and Fig. 29).



**Fig. 30**



**Fig. 31**

Fix muscles and tendon tissues with sutures to the meshes of the tube (Fig. 30 and Fig. 31).



## Implants

\*S: Implants are available with Silver coating!

\*N: Implants are available with TiN-coating!

\*SN: Implants are available with Silver and TiN-coating!

### MUTARS® humerus cap inverse

mat.: *implatan*®;  $TiAl_6V_4$  acc. to ISO 5832-3  
with TiN-coating

REF	size
5210-1000	0mm
5210-1005	+5mm
5210-1010	+10mm



### MUTARS® humerus head \*S

mat.: *implatan*®;  $TiAl_6V_4$  acc. to ISO 5832-3  
5200-0000



### MUTARS® humerus screw

mat.: *implatan*®;  $TiAl_6V_4$  acc. to ISO 5832-3

REF	size
5230-0015	M8x15 mm
5230-0035	M8x35 mm
5230-0055	M8x55 mm
5230-0075	M8x75 mm



### MUTARS® humerus stem HA cementless

mat.: *implatan*®;  $TiAl_6V_4$  acc. to ISO 5832-3 with  
*implaFix*® HA; HA-coating acc. to ISO 13779-2

REF	size
5240-0808	8 mm
5240-0809	9 mm
5240-0810	10 mm
5240-0811	11 mm
5240-0812	12 mm
5240-0813	13 mm
5240-0814	14 mm*
5240-0815	15 mm*
5240-0816	16 mm*

\*available on request.



### MUTARS® humerus stem cemented \*N

mat.: *implavit*®; CoCrMo acc. to ISO 5832-4

REF	size
5240-0408	8 mm
5240-0409	9 mm
5240-0410	10 mm
5240-0411	11 mm
5240-0412	12 mm

special stem sizes are available on request.



### glenoid cementless size 3 round

mat.: pure titanium (*cpTi*) acc. to ISO 5832-2  
with *implaFix*® HA; HA-coating acc. to ISO 13779-2  
3800-4001





# MUTARS® Humerus Inverse



## MUTARS® glenosphere

mat.: UHMW-PE acc. to ISO 5834-2

	size
REF 5210-1002	40mm



## cancellous screw size Ø 4.0mm

mat.: implatan®; TiAl<sub>6</sub>V<sub>4</sub> acc. to ISO 5832-3

	size
REF 5793-4026	26mm
REF 5793-4028	28mm
REF 5793-4030	30mm
REF 5793-4032	32mm
REF 5793-4034	34mm



## MUTARS® humerus extension piece \*S

mat.: implatan®; TiAl<sub>6</sub>V<sub>4</sub> acc. to ISO 5832-3

	size
REF 5220-0020	20 mm
REF 5220-0040	40 mm
REF 5220-0060	60 mm



## MUTARS® humerus connecting part \*S

mat.: implatan®; TiAl<sub>6</sub>V<sub>4</sub> acc. to ISO 5832-3

	size
REF 5221-0080	80 mm



## MUTARS® attachment tube

mat.: Polyethylene terephthalate (PET)

	size
REF 5900-0300	35 mm
REF 5900-0310	55 mm



## cancellous screw angle stable 4.2mm

mat.: implatan®; TiAl<sub>6</sub>V<sub>4</sub> acc. to ISO 5832-3

	size
REF 5794-4220	20mm
REF 5794-4222	22mm
REF 5794-4224	24mm
REF 5794-4226	26mm
REF 5794-4228	28mm
REF 5794-4230	30mm
REF 5794-4232	32mm
REF 5794-4234	34mm
REF 5794-4236	36mm
REF 5794-4238	38mm
REF 5794-4240	40mm

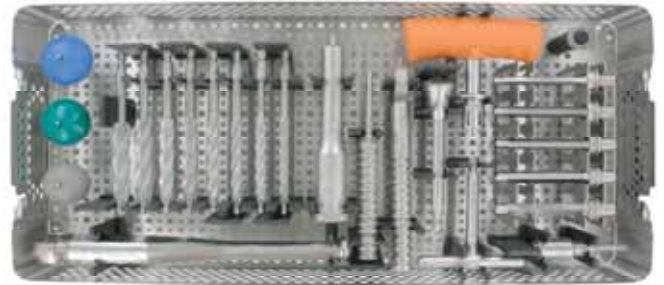


# MUTARS® Humerus Inverse

## Instruments

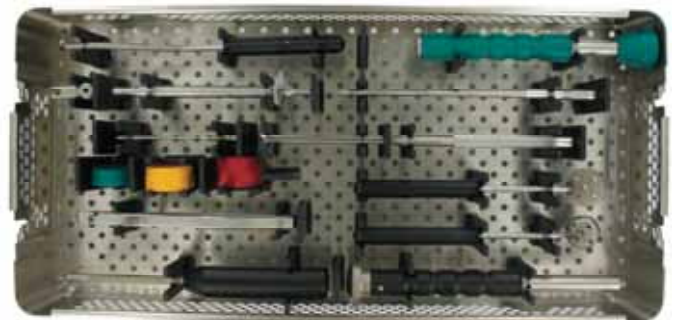
### MUTARS® humerus container

7999-5200



### MUTARS® humerus inverse container

7999-5201



### MUTARS® humerus trial container

7999-5202





# MUTARS® Humerus Inverse

**MUTARS® humerus container**  
7999-5200

**MUTARS® extractor device**  
REF 7220-0000



**MUTARS® socket wrench small**  
REF 7608-1010



**MUTARS® humerus drill ic-connection**

	size	
REF 7630-0207	7 mm	
REF 7630-0208	8 mm	
REF 7630-0209	9 mm	
REF 7630-0210	10 mm	
REF 7630-0211	11 mm	
REF 7630-0212	12 mm	



**MUTARS® medullary cavity reamer**  
REF 4220-0000



**MUTARS® rasp for humerus stem**

	size	
REF 7770-0809	9 mm	
REF 7770-0810	10 mm	
REF 7770-0811	11 mm	
REF 7770-0812	12 mm	
REF 7770-0813	13 mm	



**MUTARS® humerus impactor**  
REF 7710-0000



**MUTARS® humerus impact + extract sleeve**  
REF 7721-0000



**MUTARS® wrench for cap/ counter instrument**  
REF 7710-0001



**MUTARS® counter instrument Ø6mm**  
REF 7420-0001



**MUTARS® humerus trial cap**

	size	
REF 7710-1000	small	
REF 7710-1005	medium	
REF 7710-1010	large	



**ic- T-handle Zimmer-Jakobs**  
REF 4223-0023



**ic-adapter**  
REF 4223-0022






# MUTARS® Humerus Inverse

## MUTARS® humerus inverse container 7999-5201

### MUTARS® humerus trial cap inverse with thread

	size	
REF 7710-1201	0mm	
REF 7710-1105	+5mm	
REF 7710-1110	+10mm	

### glenoid reamer 30mm REF 7800-4030



### glenoid impactor REF 7800-4001



### MUTARS® glenoid drill guide REF 7710-1101



### hexagon screw driver 2.5mm REF 7608-1001



### depth gauge small REF 0270-1015



### glenoid drill guide REF 7800-4016



### glenosphere impactor REF 7801-0001



### drill A/O chuck 2.0mm REF 7700-0020



### fixation pin 3.2 mm x 97 mm (2 pcs) REF 4223-0008



### pin extractor REF 4223-0007 or alternatively ic-pin extractor REF 7512-0800



### pin impactor 3.2 mm REF 4223-0006




### drill guide for glenoid cementless 12 mm REF 7710-1104



## MUTARS® humerus trial container 7999-5202


### MUTARS® humerus trial cap with thread

	size	
REF 7710-1200	small	
REF 7710-1205	medium	
REF 7710-1210	large	


### MUTARS® humerus trial head REF 7710-1252



### MUTARS® humerus trial extension piece

	size	
REF 7710-0020	20 mm	
REF 7710-0040	40 mm	
REF 7710-0060	60 mm	


### MUTARS® humerus trial reducer

	size	
REF 7710-2100	10 mm	
REF 7710-2101	100 mm	

### MUTARS® humerus trial connecting part REF 7710-2180 80 mm



### MUTARS® humerus trial screw

	size	
REF 7710-2315	M8x15 mm	
REF 7710-2335	M8x35 mm	
REF 7710-2355	M8x55 mm	
REF 7710-2375	M8x75 mm	

### MUTARS® distal humerus 50mm trial REF 7710-1275





# MUTARS<sup>®</sup> Humerus Inverse

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