rematitan® Casting System

Prosthetic instructions
Prothetic instructions

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1 General information

Pure titanium, which is sold under the trade name Tritan or rematitan®, has a purity grade of > 99.5%. This is in accordance with DIN 17580 for pure titanium.

The especially strong affinity of titanium to oxygen is taken into consideration in the melting and casting process with the from Dentaurum developed casting units. In the casting unit, pure titanium is melted with an electric arc by means of evacuation and argon flooding of the chamber. A copper mould is used as a melting crucible, so that the titanium can be melted without reacting to the crucible.

At the end of the melting cycle, the crucible is tilted and the titanium flows down into the the casting ring containing rematitan® Plus, rematitan® Plus Speed, rematitan® ultra or Trinell investment materials, especially developed for the titanium casting technique.

The reactive layer, also called the „alpha case“ layer, formed at the contact zone between the titanium casting metal and the investment should be kept as thin as possible. Titanium has special properties such as low specific gravity, high melting point, low contraction and very high affinity for oxygen. For this reason any factors which could influence titanium must be dealt with differently to conventional dental castings. This includes all the materials and operations intended specifically for the casting unit. Other materials may have an adverse affect on the casting results.

State-of-the-art investment materials such as rematitan® Plus Speed and Trinell provide a maximum degree of flexibility and best possible casting results. rematitan® Plus Speed is a universally adaptable investment material for both model castings and crowns and bridges. It can be used for speed heating as well as the controlled overnight pre-heating method. Trinell is a speed heating investment material for crowns and bridges. Its characteristics include its precision and almost oxide free casting results.

Please follow the instructions very carefully. Especially with titanium casting, deviations can have negative effects. In order to use these investment materials accurately, please follow the relative instructions for use.
2 Crowns and bridges made of titanium
Using the investment materials rematitan® Plus, rematitan® Plus Speed, Trinell, rematitan® ultra

2.1 Preparation
Waxing of crowns and bridges can be done with the usual materials. Crowns and bridges are waxed up in the usual way. Minimum wall thickness 0,5 mm.

Note! Use only waxes (Dentaurum StarWax) or resins which leave absolutely no residue.

2.2 Spruing System – Single Crowns / Inlays (pictures A and B)
Single crowns and inlays are usually waxed-up on a runner bar.
Pattern leads diameter 3 mm, length 3 mm.
Runner bar diameter 4 mm.
T-shaped main sprue, diameter 4 mm.
Main sprue attached to the runner bar between two leads.
Accurate positioning of the object within the casting ring: approx. 5–8 mm under the upper edge of the casting ring.

2.3 Spruing System – Bridges (pictures C and D)
T-shaped main sprue Ø 4 mm. Runner bar Ø 4 mm.
Main sprue connected to the runner bar between two sprue leads.
Pattern leads Ø 3 mm, length 3 mm.
Each bridge component must be sprued to the runner bar at its highest point. Larger components, such as full crowns etc., may also have 2 leads. Align the patterns such that the sprue cone sits centrally in the casting ring. Bridges that extend over 8 or more units must have two 4 mm main sprues to the runner bar.
2.4 Casting ring system

To avoid gas entrapment during casting, the sprue cone must be of a certain shape. Use only the muffle bases belonging to the system with sprue formers.

Muffle base with sprue former:

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 piece</td>
<td>REF 106-850-01</td>
</tr>
<tr>
<td>6</td>
<td>1 piece</td>
<td>REF 106-851-01</td>
</tr>
<tr>
<td>9</td>
<td>1 piece</td>
<td>REF 106-852-01</td>
</tr>
</tbody>
</table>

The base plate must be completely clean.

Casting rings, flexible:

Used with *rematitan® Plus, rematitan® Plus Speed*

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 piece</td>
<td>REF 106-840-00</td>
</tr>
<tr>
<td>6</td>
<td>1 piece</td>
<td>REF 106-841-00</td>
</tr>
<tr>
<td>9</td>
<td>1 piece</td>
<td>REF 106-842-00</td>
</tr>
</tbody>
</table>

Casting rings, metal:

Used with *Trinell, rematitan® ultra and rematitan® Plus Speed*

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 piece</td>
<td>REF 106-801-00</td>
</tr>
<tr>
<td>6</td>
<td>1 piece</td>
<td>REF 106-802-00</td>
</tr>
</tbody>
</table>

Fixing ring for connecting casting ring and base

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 piece</td>
<td>REF 106-845-00</td>
</tr>
<tr>
<td>6</td>
<td>1 piece</td>
<td>REF 106-846-00</td>
</tr>
<tr>
<td>9</td>
<td>1 piece</td>
<td>REF 106-847-00</td>
</tr>
</tbody>
</table>

2.5 Wax-Up

To achieve a clean and rapid melt rapid flow of molten metal, joints of the sprue cone and onto the pattern should be smooth and round.

Align the pattern horizontally.

Maintain the distance from the edge of the casting ring to approx. 6 mm.

Distance from wax pattern (rounded edges) to the upper edge of the casting ring approx. 5–8 mm

2.6 Amount of casting metal required per casting

<table>
<thead>
<tr>
<th>Type of Cast</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single crowns</td>
<td>18 g</td>
</tr>
<tr>
<td>Bridges up to 6 units</td>
<td>22 g</td>
</tr>
<tr>
<td>Bridges of 7 and more units</td>
<td>31 g</td>
</tr>
<tr>
<td>Very large bridges (14 units)/extensive supra constructions</td>
<td>36–40 g</td>
</tr>
</tbody>
</table>
3 Model casting in titanium
Using the investment materials rematitan® Plus or rematitan® Plus Speed

3.1 Duplication with rematitan® investment material
After appropriate preparation, the master model is duplicated with rema®-Sil silicone (REF 108-700-00/108-701-00) or ecosil Silicone (REF 108-703-00/108-704-00).

Note! Minimum thickness of the refractory at the deepest part of the palate is 15 mm. If necessary, increase the height of the master model before duplication. Higher models may be trimmed down. In the case of split cast models etc., the investment model should be trimmed down to proper size before investing.

3.2 Recommended waxing
If titanium casting metal is used for model casting, the construction of the framework should have thicker dimensions because of the different physical values compared to that to CoCr alloys.

<table>
<thead>
<tr>
<th>Framework Type</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper jaw full palate</td>
<td>0.8 mm</td>
</tr>
<tr>
<td>Upper jaw horseshoe</td>
<td>0.8–1.0 mm</td>
</tr>
<tr>
<td>Upper jaw anterior-posterior palatal bar</td>
<td>0.8–1.0 mm</td>
</tr>
<tr>
<td>Upper jaw palatal strap</td>
<td>0.8–1.0 mm</td>
</tr>
</tbody>
</table>

Additionally reinforce lower jaw lingual bars 4.3 x 2.3 mm (REF 111-113-00).

All the figures are recommendations. Stabilization can also be achieved by waxing-in reinforcements. The wax and plastic patterns used should be suitable for titanium casting. (All Dentaurum waxes and acrylic templates are suitable)

Note! Do not use alien adhesives. To guarantee that the molten titanium flows properly into the mould, be sure the wax/acrylic surface is smooth and clean.
1 Upper horseshoe
   1 main sprue Ø 5 mm
   2 auxiliary sprues Ø 3 mm
2 Upper anterior-posterior palatal bar
   1 main sprue Ø 5 mm
   1 auxiliary sprue Ø 4 mm
3 Upper palatal strap
   1 main sprue Ø 5 mm
   2 auxiliary sprues Ø 3 mm
4 Upper full palate
   2 main sprues Ø 4 mm, 10–15 mm long
   Model at 45° angle.
   In case of resin relining of a-line, position sprues within the palatal plate.
5 Lower lingual bar
   2 main sprues Ø 4 mm

1a–5a rematitan® castings sand-blasted, sprues removed.
3.3 Use of rematitan® M-(Ti4) casting metal

rematitan® M has a higher elongation limit, tensile strength and modulus of elasticity values.

rematitan® M has slightly poorer flow properties than the more commonly used titanium Ti1. However, it is easier to cast than is normally the case when using titanium grade 4.

Slight modification of the casting sprues allow the fabrication of very delicate partial dentures.

Casting sprues
With very delicate model casting structures, 3 or 4 sprues, with a diameter of 3, 4 or 5 mm, are joined to the wax-up from below in the form of a star.

3.4 Spruing system/sprue
All model castings are cast from the top.

3.5 Sprue formers for model casting
Plastic sprue cones should be used.

**Note!** Do not use other cone shapes than recommended.

The shape of the sprue cone and the position of the sprue channel help the melt to flow cleanly. The funnel must be in the center of the casting ring, so that the casting ring can be centered cleanly in the unit.

Ensure that the sprue cone is positioned horizontally!

If using the rema®-Form-Casting ring system check the maximum height for the sprue cone!

Always use a sprue cone REF 090-027-00!
3.6 Preparation for investing
In order to avoid loss of pressure during the casting process, there must be a tight bond between the refractory model and the investment ring. Any deviation from the recommended materials and procedures may result in cracking of the ring due to the expansion characteristics of the investment material. This will result in miscasts.

3.7 Trimming the model before investing
The models are dry trimmed up to the waxed patterns. The model should be 10–15 mm thick at the lowest point. Models which are too thick are trimmed flat on the base to dimensions.

The models for a full upper jaw are trimmed from the front so that the model has a standing surface which is angulated at 45°. Distance between the wax model and standing surface approx. 5 mm.

3.8 Casting ring rema®-Form red (REF 127-307-00) and blue (REF 127-308-00)
Choose the casting ring according to the refractory model size. The distance to the wax model should be at least 8–10 mm. Spread vase-line thinly over the inside of the casting ring.

Do not insert lining tape. Casting is done without the casting ring.

Place the casting ring on the base plate and fix the position of the model. Be sure the sprue cone is in the center of the ring.

3.9 Fixation on the base plate
Seal the wax up refractory to the smooth ring base (REF 127-309-00) using sticky wax. The sprue former must be centered perpendicularly in the middle of the casting ring. Press on the casting ring.

3.10 Investing
For one casting ring 2 x 250 g packs of rematitan® Plus or rematitan® Plus Speed investment material are required.

For small models and a red muffle ring, and generally for blue casting rings, 3 x 250 g packs are used.

Note:
Fill the muffle to 1 mm below the edge of the sprue former. Be sure that the surface is smooth and without bubbles.

Break investment material at the outer muffle edges.

Note:
Do not trimm the surface with a model trimmer.
3.11 Preheating
Place investment mold in the oven with the sprue opening facing down.
Be sure the base of the oven is clean.

3.12 Preheating oven
The oven should be equipped with a 3- to 4-sided heating chamber and well-insulated.
Required end temperature 1000°C/1832°F.
A programmable furnace is imperative. Circulating air is advisable. Do not fill the oven to its capacity. Furnaces without sufficient insulation or where the temperature increase decrease rate is too high may cause mould cracking.

3.13 Amount of titanium casting metal required per casting
Normal framework casting 31 g
Frameworks of large dimension 36 g–40 g
4 Titanium one-piece casting technique using rematitan® Plus, Conical crowns

One-piece casting for crowns of 2° and 4° taper is possible with the following procedure.
Telescopic crowns are dealt with separately in chapter 5.

4.1 Preparation
Wax up primary crowns on the master model.
Angulation (tapering) 2° or 4°.

4.2 Duplication
Duplicate the master model with the primary crowns using rema®-Sil silicone (REF 108-700-00/108-701-00).

4.3 Producing the duplicate model from rematitan® Plus investment
Degrease the negative silicone mould with Lubrofilm® (REF 112-050-00).
Mix rematitan® Plus investment material (REF 107-600-00) and rematitan® Plus mixing liquid for model casting (REF 107-601-00) in a ratio of 250 g : 40 ml and fill the silicone mould.

4.4 Setting time
40 minutes

4.5 Drying the model
70 °C/158 °F, 40 minutes
Harden the model with rematitan® cold hardener.

4.6 Recommended waxing
Upper jaw horse shoe thickness 1 mm
Upper jaw skeletal plate thickness 1 mm
Upper jaw transversal bar thickness 1 mm
Additionally reinforce lower jaw lingual bars.
□ To ensure complete casting of secondary crowns the minor connectors must be waxed thicker.
□ Waxing thickness of the secondary crowns not less than 0.5 mm.
4.7 Spruing system
In the upper jaw, attach 2 sprue channels of 4 mm diameter in the form of a v in the dorsal region. Length of the sprue channels are approx. 10 mm.

The standard spruing system is used in the lower jaw.
(see page 8)

4.8 Preparation for investing
The models are trimmed on the side to the waxed portions. The subsequent standing surface of the model is trimmed at an angle of 45°. Distance from the waxed model to the base surface approx. 4 mm. In contrast to conventional titanium model casting, the upper jaw one-piece casting models are waxed onto the base plate at an angle of 45°.

Lower jaw refractory models are waxed as usual.

4.9 Casting ring
The blue muffle ring for all upper jaw models.
The red or blue muffle ring for all lower jaw models.

With models waxed-up at an angle of 45°, the undercut areas on the investment model are filled with rematitan® Plus investment using a large brush before mounting the muffle ring. This prevents from bubbles on the wax model.

Setting time 40 minutes. Peel off the muffle base.

4.10 Investing
For the upper jaw (blue muffle), 3 x 250 g packs are required.
Mixing ratio = 750 g : 120 ml.

4.11 Standing times, holding times, temperatures
The parameters for the rematitan® Plus instructions apply.
5  Titanium single-piece casting technique using rematitan® Plus, Telescope crowns

5.1  Preparation

The primary crown in the silicone mould is first filled with rematitan® Plus investment, which is mixed with diluted rematitan® Plus mixing liquid for crowns and bridges (REF 107-602-00).

Note: Recommended concentration for crowns and bridges is approx. 80% (20% distilled water)

Powder ratio : liquid: 100 g : 16 ml.

Keep liquid in the refrigerator.

Before the investment has set, the mould must be filled with rematitan® Plus investment in the normal consistency of 250 g : 40 ml (mixing liquid for model casting, REF 107-601-00).

The subsequent operating steps are the same as sections 4.4 to 4.11 of the instructions for conical crowns.

5.2  Amount of Titanium casting metal required per casting

Minor combination work 31 g

Extensive combination work 36 g–40 g
6 Trimming titanium castings

6.1 Safety advices

Wear protective glasses!

Abraded or separated titanium particles when hot react with oxygen and produce sparks.

Caution: Risk of combustion and explosion. Cool the workpiece with water.

Attention: If suction lines are used, change the filter paper regularly. Warning: Otherwise fire hazard.

Warning! Always use trimming materials only for processing titanium. Keep separate!

6.2 Cutting of sprues

Warning! Do not overheat the casting when separating. Cool. No red heat.

For recommended separating discs, see finishing kit.

6.3 Grinding

If possible, use carbide burs and trim in one direction. Tungsten carbide burs are particularly suitable.

Grinding points can be used for smoothing surfaces.

Note! Use carbide burs and grinding points only for trimming titanium. Keep separate!

6.4 Preparation for ceramic bonding

Surfaces which are to be blended with ceramic must be finished entirely with carbide burs. The amount of material removed depends on the particular material thickness. Afterwards, sandblast the framework surface with aluminium oxide and condition according to the ceramic manufacturer's instructions.

6.5 Rubber polishing

When rubber polishing, it is essential to avoid severe heating of the polishing surfaces!

For recommended rubber polishers, see finishing kit.

Uniform smoothing of the metal surface to be polished is achieved if this has been ground with very fine emery paper (500–1000 grain) in a sandpaper holder.

6.6 Acid treatment

Do not place titanium castings in hydrofluoric acid. Titanium is quickly damaged by hydrofluoric acid!

6.7 Polishing

Polish and shine with a soft polishing brush and special titanium polishing paste (Tiger brillant, REF 190-350-00).

Note! To form a passivity layer, leave polished work exposed to air for at least 10 minutes. Subsequently steam clean or use ultrasonic cleaner.
7 Finishing titanium casting using the rematitan® finishing kit

7.1 Safety advices
Always wear safety goggles when finishing castings.
Always turn on the extractor unit during work.

Attention
The maximum rotation speeds of the various instruments must not be exceeded.

7.2 Description
Pure titanium is a soft tough material which requires special procedures for finishing and polishing. The Finishing Kit (REF 135-500-00) contains the most important materials for the efficient finishing and polishing of titanium for dental purposes.

The sequence of use and the most important finishing characteristics of the individual instruments are described below.

7.3 General Notes
- Use the finishing materials for titanium only
- The grinding tools must not become clogged. This precludes the use of other types of tool (e.g. diamonds) for finishing purposes.
- In addition, local overheating of the workpiece must be avoided. For this reason, care must be taken when using rubber polishers.
- Do not exert too much pressure and work at low speeds.

7.4 Preliminary operation
Titanium castings are always covered by an oxide skin which must be removed carefully before work begins. This is done with the blasting unit and blasting medium of various grades.

Note: Sparks are always created when finishing titanium.

When using rematitan® Plus investment material:
Model casting: blasting type Al₂O₃ blast (< 250 µm)
Crowns and bridges: blasting type Al₂O₃ blast (< 125 µm)

Important: Do not damage the edges of the crown – do not exert too much pressure.

When using rematitan® Ultra or Trinell-Einbettmasse:
blasting type Al₃O₅ blast (30 µm–250 µm)

For very fine parts (inlays) careful blasting with polishing beads is sufficient.

7.5 Procedure for finishing titanium
Follow the finishing instructions in the correct sequence. This enables you to achieve an excellent polish on the titanium with very little effort and expense.

Preparation of surfaces for ceramic applications:
- use tungsten carbide burs only
- blast carefully with Al₂O₃ (125 µm–250 µm) and 2–3 bars of pressure.

Important: After polishing, the workpiece must be allowed to passivate in the atmosphere for 10 minutes before cleaning with steam jet or ultrasonic cleaner.

In addition to the component numbers, observe the order numbers for spare parts!
8 Casting with alloys

All customary dental alloys for prosthetics can be cast (only autocast universal®).

The alloys are melted on a special ceramic crucible. The electric arc is deflected over an electrode that is set in the crucible.

The output of the electric arc is regulated according to the alloy being used. The tipping of the crucible is done manually via the viewing window.

8.1 Preparing the casting ring

Prepare casting object as usual, either with a sprue bar or directly.

The use of metal muffle rings is strongly recommended.

Depending on the investment material or preheating program, in some cases micro cracks can form in the investment material. Cracks can lead to inferior pressure values when casting and therefore produce a poor casting reaction.

When model casting, the stability of the casting muffle has to be considered. If necessary, metal muffle rings can also be used.

8.2 Sprue formers

It is essential to use sprue formers from the rematitan® casting system, or other bases with sprue formers that have a clean and smooth base.

In order to seal the casting chamber, it is important to have a complete and smooth seal. When model casting, it is also recommended to use the rematitan® sprue formers.

Attention! Do not use sprue formers which do not provide a perfect sealing (i.e. BEGO etc.).

8.3 Preheating the casting ring

The muffles are preheated, independent of the casting process, according to the instructions for the investment material and casting alloy.
8.4 Ceramic seal

Only high temperature ceramic seals should be used.
(Ceramic seal C – REF 090-012-60)

Multiple uses are only suitable when the muffle base is very smooth. Do not reuse more than three (3) times.

8.5 Ceramic crucible and crucible electrode

Two sizes of ceramic crucibles can be used when casting with alloys. The small crucible REF 090-161-00 can be used for up to 36 grams of non-precious metals and for up to 45 grams of precious metal alloys.

The large crucible REF 090-161-50 can be used for a maximum of 54 grams of non-precious alloys and a maximum of 95 grams of high gold containing alloys.

Attention: Precious metal reduced alloys have a lower specific weight, therefore, the maximum melting weight is clearly reduced when compared to high gold containing alloys.

Use a separate ceramic crucible for every alloy!

The crucible electrode should also only be used for one alloy.

Repeated use of the ceramic crucible for up to 40 times is possible, depending on the alloy being used.

The ceramic crucible cannot be cooled down in water after casting (danger of breakage). Without cool down, the crucible can be adjusted up to three times by using tongs or tweezers.

The crucible electrode has to protrude slightly from the ceramic pan. Do not sharpen the electrode! Connect the electrode with a wrench with the copper crucible support, and tighten.

8.6 Melting electrode

The melting electrode in the upper melting chamber has to be well sharpened. The position of the melting electrode remains the same when casting with alloys or titanium. The space between both electrodes is 15 mm when casting alloys. Small differences of ± 1 mm do not have an influence on the casting.

8.7 Melting process

Controlling the output

The power output of the casting machine is controlled by an inverter from 5% to 100% by use of a potentiometer. The predetermined output setting does not only depend on the melting temperature of the alloy, but also the quantity of the casting metal.

Due to excessive cooling down of the casting muffle, the melting time should not exceed 40–50 seconds. An automatic safety device tips the crucible after a maximum of 90 seconds.

The suggestions that are mentioned with reference to the output settings, and depending on the melting amount, represent rough guidelines. The output may deviate at different melting temperatures. At the same time, the condition of the melting electrode influences the performance of the electric arc. Electrodes that become dull after many castings decrease the performance.

If necessary, the output can be corrected either up or down during the melting process.

Average setting “non-precious metal”: 50%
Average setting “precious metal”: 15%
8.8 Recognizing the point of casting

After igniting the electric arc, the melting process can be monitored through the darkened viewing window. At low output settings, the second darkened window can be pushed aside in order to improve the visual monitoring.

**Attention:** At a higher output > 50%, the second safety viewing glass has to remain, otherwise eye damage may occur due to the bright beam of light.

The casting process is manually controlled via the “cast” button when the melt builds a uniform mass.

Precious and non precious alloys must be cast immediately when the melting point has been reached **without any additional temperature soaking**. To avoid partially melted ingots, place them in an overlapping pattern and have them contact one another on the crucible. Ensure a good contact of the metal to the crucible electrode. Avoid placing the ingots in the rear area of the crucible, they are obscured from vision behind the electric arc.

8.9 Cleaning

Melt residues and splatters have to be removed after every casting process. Especially particles in the funnel between both chambers.

The window of the casting chamber has to be cleaned on a regular basis. (In order to observe the melting process).

Both chambers have to be cleaned regularly.

9 Information Service by Telephone

Contact our Prosthetics Department for any questions you might have

Hotline +49 72 31 / 803-410