

# Troubleshooting Guide

**Titanium Casting**



**DENTAURUM**

## ENGLISH

### Dear Customer

Titanium casting is a technique that is now routinely used in many laboratories. But when work becomes routine, it often results in slight carelessness and errors which cause unnecessary problems.

This brochure is intended to help you identify and remedy the cause of any problems when casting titanium.

This troubleshooting guide does not deal with porcelain facings on titanium frameworks. A separate brochure on porcelain can be obtained gratis from ESPRIDENT, the DENTAURUM subsidiary for porcelain, which also supplies Triceram® bonding porcelain for titanium.

(Order no. 989-676-20, Tips for working with Triceram® titanium porcelain)

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**Titanium troubleshooting guide**  
**Rematitan® Plus investment**

Problem	Cause	Remedy
Bubbles in the investment mix	Insufficient vacuum, inadequate mixing or air evacuation	Check vacuum and seals of the vacuum mixer. Adhere to mixing time.
Investment sets too rapidly	Temperature of the liquid too high  Measuring beaker used for other liquids (e.g. Rematitan® Ultra)	Store the mixing liquid all year round in a refrigerator (12°C - 14°C).  Only use the measuring beaker for Rematitan® Plus liquid.
Surface of the investment model (CrCo) powdery after drying  or  Wax patterns do not adhere to the investment model	Drying time too long or temperature too high  Too much moisture retained in the model (strong ammonia odour)	Fan-assisted drying cabinet: drying time 40 minutes at 70 °C. Then dip in Rematitan cold model hardener for 5 seconds. Dry the model after dipping for 5 minutes at 70 °C.  Non fan-assisted drying cabinet or preheat furnace: 40 minutes at 100 °C. Then dip in Rematitan cold model hardener for 5 seconds. Dry the model after dipping for 5 minutes at 100 °C.
Moulds crack during preheating	Not adhering to preheat times and temperature  Cools too quickly from 1000 °C to 430 °C e.g. furnace door open or badly sealed furnace  Furnace temperature control faulty  Furnace temperature too high when inserting moulds	Adhere to investment instructions for use.  Keep the furnace door closed during the cooling phase. Cooling from 1000 °C to 430 °C takes approx. 2.5 – 3 hours.  Check furnace setting/ thermocouple/control.  Allow the furnace to cool to room temperature.

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Problem	Cause	Remedy
Moulds crack during preheating	Storage temperature of mixing liquid too high	Store liquids in a refrigerator all year round (approx. 12 °C -14 °C).
CrCo moulds crack during casting	<p>Sprue former not positioned in the centre of the casting ring. This causes uneven distribution of pressure during casting.</p> <p>Investment model too thin</p> <p>Investment too thin around the model</p> <p>Investment too thin over the model</p> <p><u>Only with Castmatic casting machines:</u> argon pressure set too high.</p>	<p>Place the sprue former centrally to the model or reposition the sprue and sprue former.</p> <p>Model should be 10 –15 mm thick at its deepest point. if necessary, increase the thickness of the model base prior to duplication.</p> <p>Minimum thickness of investment around the model should be 10 mm.</p> <p>Investment thickness should be approx. 30 mm from the residual teeth to the top of the sprue former.</p> <p>Set the argon pressure on the cylinder pressure gauge to 0.8 bar.</p>
CrCo moulds crack during casting, especially with full plates	Insufficient investment over full plate model	Trim back the distal area of the model up to the wax pattern. Wax the model upright onto the base at an angle of 30°- 45°.
Incomplete casting	<p>Sprue positioning incorrect</p> <p>Insufficient amount of metal</p>	<p>Position sprues correctly, see instructions.</p> <p>Always use 31g or 36g for casting CrCo frameworks. For crowns and bridges up to 6 units 22g, more than 6 units 31g, 14 units 36g.</p>

E N G L I S H

Problem	Cause	Remedy
<p>Incomplete casting</p>	<p>Mould and seal not properly centred at the copper crucible throat. The molten metal flows over the seal. This reduces the flow velocity.</p> <p>Seal too old, poor seal</p> <p>Wax patterns for crowns and bridges positioned too low in the mould</p> <p>Mould cracked</p> <p>Incorrect pattern thickness</p> <p>Molten metal not hot enough:</p> <p>Mould not hot enough</p> <p>Tip of electrode blunt</p> <p>Electrode gap incorrect</p> <p>Crucible over-oxidized, causing a loss of energy</p>	<p>Press the mould and seal onto the centre of the seal on the copper crucible throat.</p> <p>Renew the seal.</p> <p>The upper edge of the wax pattern should be approx. 8 mm – 10 mm below the rim of the casting ring.</p> <p>See "Moulds crack".</p> <p>Thickness for crown and bridge patterns 0.5 mm, upper CrCo 0.8 – 1 mm, lower CrCo bar 4.3 x 2.3 mm.</p> <p>Casting temperature of the mould 430 °C</p> <p>Regrind the electrode to an angle of 50°.</p> <p>Adjust the electrode gap to 5 mm with a gauge.</p> <p>Sandblast the crucible with Al<sub>2</sub>O<sub>3</sub>, 110 – 125 µm.</p>
<p>Inclusions in the castings</p>	<p>Mould cracked, resulting in reduced argon pressure and insufficient vacuum.</p> <p>Insufficient amount of metal</p> <p>Incorrect sprue position</p>	<p>See "Moulds crack".</p> <p>Use the correct amount of metal. CrCo casting 31g or 36g, crowns and bridges up to 6 units 22g, more than 6 units 31g, 14 units 36g</p> <p>Adhere exactly to the prescribed sprue position – see instructions for use.</p>

## E N G L I S H

Problem	Cause	Remedy
<p>Inclusions in the castings</p>	<p>Crucible misshapen due to ageing. The molten metal no longer flows through the centre of the copper crucible throat.</p> <p>Mould and seal not fitted in the centre of the seal on the copper crucible throat .</p> <p>Molten metal not hot enough:</p> <p>Tip of electrode blunt</p> <p>Electrode gap incorrect</p>	<p>Replace the crucible.</p> <p>Press the mould and seal onto the centre.</p> <p>Regrind the electrode to an angle of 50°.</p> <p>Adjust the electrode gap to 5 mm with a gauge.</p>
<p>Inaccuracies in fit</p>	<p>Crowns fit too tightly at the incisal or occlusal</p>	<p>Select a suitable spacer for these areas. Vacuum-formed foil with spacers are recommended.</p>

**Titanium troubleshooting guide**  
**Rematitan® Ultra investment**

Problem	Cause	Remedy
Bubbles in the investment mix	Inadequate mixing under vacuum	Mix for 120 seconds under vacuum. Check the vacuum.
Mixture too grainy	Mixing time too short.	Mix for 120 seconds under vacuum.
Investment takes too long to set (longer than 2 hrs).	Liquid and powder too cold	Temperature of the liquid and powder should be 18° - 21 °C. Setting takes longer if the temperature is less than 18 °C.
	Mixing liquid and powder contaminated with other investments	Use a separate measuring beaker and mixing bowl for Rematitan® Ultra.
Moulds crack during preheating	Base former removed from mould too soon	Allow the mould to stand 1½ - 2 hrs depending on room temperature before placing in the furnace.
	Metal casting ring not used	Use a cylindrical metal casting ring. Use a 1 mm thick ring liner.
	Size 9 casting ring used	Recommended casting ring sizes 3 and 6
	Furnace set for weekend	Set furnace for overnight.
	Furnace temperature too high when inserting moulds	Allow the furnace to cool to room temperature.
	Mixing liquid and powder contaminated with other investments	Use a separate measuring beaker and mixing bowl for Rematitan® Ultra.
	Moulds too close to the door or heated walls in the preheat furnace	Position as close as possible to the centre of the furnace chamber.
Too many moulds in the preheat furnace	Fill furnace to max. 2/3 capacity.	

## E N G L I S H

Problem	Cause	Remedy
<p>Moulds crack during preheating</p>	<p>Wax patterns too close to the casting ring or not enough investment over the pattern</p> <p>Ring liner not shortened</p> <p>Ring liner too thick</p> <p>Paper ring liner</p> <p>Due to the different types of furnaces, cracks can occur despite special batch temperature and heat soak times.</p> <p>Faulty furnace temperature control</p>	<p>Distance between wax pattern and casting ring approx. 6 – 8 mm. Distance from the wax pattern to the top of investment approx. 8 – 10 mm.</p> <p>Shorten the ring liner. Leave a 5 mm area at both ends of the casting ring without ring liner.</p> <p>Use a 1 mm thick ring liner. (mineral ring liner, e.g. Kera ring liner)</p> <p>Use a mineral ring liner.</p> <p>Calibrate the preheat furnace regularly, see page 12.</p> <p><u>Fan-assisted furnaces:</u> use the same temperature as that given in the batch instructions. Extend the heat soak time gradually by 10 – 30 minutes.</p> <p><u>Non fan-assisted furnaces:</u> generally increase the temperature given in the batch instructions by 10 °C and gradually increase the heat soak time by 10 – 30 minutes.</p> <p>Calibrate the preheat furnace. Check the accuracy of the temperature, see page 12.</p>
<p>Incomplete casting</p>	<p>Cracked mould</p> <p>Incorrect pattern thickness</p>	<p>See “Moulds crack”.</p> <p>Pattern thickness 0.5 mm</p>





## E N G L I S H

Problem	Cause	Remedy
<p>Inclusions in the castings</p>	<p>Crucible misshapen due to ageing. The molten metal no longer flows through the centre of the copper crucible throat.</p> <p>Molten metal not hot enough:</p> <p>Tip of electrode blunt</p> <p>Electrode gap incorrect</p>	<p>Replace the crucible.</p> <p>Regrind the electrode to an angle of 50°.</p> <p>Adjust the electrode gap to 5 mm with a gauge.</p>

## **Preheat furnace temperature check – basic requirement for the correct use of Rematitan® Ultra investment**

Rematitan® Ultra titanium investment requires very accurate temperature regulation to provide the benefits of its excellent properties. A fan-assisted preheat furnace heated on four sides, such as the Protherm from Dentaaurum (Order no. 096-180-00), is recommended.

The procedure for checking the (actual) temperature reached by the preheat furnace is as follows:

1. Place a piece of pure silver wire approx. 10 mm long (goldsmith or silversmith) on an old porcelain support tray and insert it in the preheat furnace. Set the final temperature to 955 °C and heat up the furnace. Check the wire after holding the temperature for 30 minutes. The wire should not yet be ball-shaped.
  2. Now set the temperature to 965 °C and wait another 30 minutes. Since the melting point of silver is 961 °C, the silver should now be ball-shaped if the furnace temperature is correct.
  3. If the silver wire is still in the form of a wire, checks should be continued in stages of 10 °C with a holding time of 30 minutes. The resulting temperature difference on the furnace control should be taken into account in future when setting the final furnace temperature for the investment.
- ☞ A check should be carried out every 6 months, as the furnace coils age relatively quickly.

## **Precast functional check Autocast, Autocast Plus, Rematitan**

- 1. Check that the chamber and copper crucible are clean and free of titanium residue.**
- 2. Check the tip of the tungsten electrode.**  
If the tip is blunt, regrind to an angle of 50° using a tungsten carbide cutter.
- 3. Check the distance to the electrode with a gauge.**  
The distance between the tip of the electrode and the titanium ingot should be 5 mm.
- 4. Check the copper crucible.**  
Sandblast the oxide layer away completely after 3 castings using Al<sub>2</sub>O<sub>3</sub>, grit size 110 – 125 µm.

## **Preparing for casting**

- 5. Open the argon cylinder and check the level and cylinder pressure.**
  - 6. Switch to "ON".**
  - 7. Insert the crucible.**
  - 8. Position the titanium ingot on the crucible.**
  - 9. Enter the weight of the titanium ingot in the casting machine.**
  - 10. Press the mould and seal onto the seal of the copper crucible.**
  - 11. Check that the mould is pressed onto the centre.**
  - 12. Close the door.**
  - 13. Press "Start".**
  - 14. The programme is fully automated.**
  - 15. The programme is complete when both manometer indicators are at "0" (Autocast, Autocast Plus).**
  - 16. Open the door, remove the mould and quench it with water.**
  - 17. Remove the crucible and quench it with water.**
  - 18. Switch to "Off".**
  - 19. Close the argon cylinder.**
- P.S.:** Information about the maintenance of your casting machine is included in the instructions for use supplied with the casting machine.

## Precast functional check - Castmatic -

1. Open the argon cylinder.
2. Switch to "ON".
3. Set the power control to 10.
4. Check both chambers to ensure that they are clean (titanium residue on the tip of the electrode).
5. Check that the clamp in the upper chamber moves easily.
6. Insert the crucible carrier and crucible and ensure the markings are correctly placed.
7. Insert the ingot and set the electrode tip gap to 5 mm using a gauge (unscrew and tighten the grub screw with an Allen key).
8. Enter the melting times.
  - 22 g = 28 sec.
  - 31 g = 38 sec.
  - 36 g = 42 sec.
9. Remove the crucible carrier, crucible and ingot from the upper chamber again.
10. Insert the mould with the seal in position in the lower chamber and raise the lift to grip the mould (do not exert too much pressure).
11. Check the access from the upper to the lower chamber - is the sprue hole in line with the crucible throat?
12. Insert the crucible carrier, crucible and ingot and close the doors.
13. Press "Start". The casting procedure is automatic.
14. The yellow indicator should show 0.75 – 0.78 and the white indicator plus 0.8 bar. If the yellow indicator drops to 0, the mould is not sealed (cracks or incorrect programme entered).
 

Remedy: - switch off

  - open the door
  - check the mould
  - press once again
  - close the door
  - turn the dial to zero and re-enter the required melting time
  - press "Start"
15. After flooding both chambers to zero, open the door, lower the lift, remove the mould and quench it immediately.
- 16a. Remove the crucible and quench it immediately.
- 16b. If the crucible throat and sprue button are connected, do not use force to remove the mould.  
Remove the lower spacer and turn the mould to remove it from the chamber.
- 17a. Remove any residual titanium from the crucible and blow dry.
- 17b. If the residue in the crucible does not loosen, do not try to remove it with an instrument. Loosen by lightly tapping the back edge of the titanium residue. Remove any titanium still adhering to the crucible with a rubber polisher.
18. Further castings and checks as from 4.

## Copper crucibles for Dentaurnum titanium casting machines

- Order no. 090-110-00 for Rematitan® and Rematitan® Autocast
- Order no. 090-010-00 for Castmatic

These procedures should be followed to ensure the best results from the crucible:

- ☞ Always use dry, clean crucibles for casting.
- ☞ Sandblast oxidised crucibles in the sandblaster (with  $\text{Al}_2\text{O}_3$ , 110 – 250  $\mu\text{m}$ ).
- ☞ Always use original Rematitan® ingots.
- ☞ Place the ingot on the crucible according to the positioning zones (see instructions for use for the casting machine).
- ☞ Place the crucible correctly in the crucible carrier (see instructions for use).
- ☞ Adhere to the melting times for the different weights of ingot:

<u>Casting weight:</u>	<u>22 g</u>	<u>31 g</u>	<u>36 g</u>
castmatic:	28s	38s	42s
rematitan®:	29s	40s	46s
autocast:	32s	43s	49s

**Note:** The condition of the electrode and the electrode gap also affect the melting process, which in turn affects the thermal stress on the crucible. We therefore recommend:

- ☞ checking the electrode gap with a gauge and centring correctly
- ☞ checking the electrode tip
- ☞ sandblasting the oxidized electrode

### Extended melting times result in the crucible overheating and delay

- ☞ Always remove the crucible **immediately** after use and quench it in cold water.
- ☞ Do not allow titanium residue to cool on the crucible.
- ☞ Do not throw or hit the crucible.
- ☞ Do not use force to remove titanium residue sticking to the crucible. Loosen by lightly tapping the back edge of the **titanium residue**.
- ☞ Use a rubber polisher to remove any titanium residue adhering to the crucible.
- ☞ Replace worn or cracked crucibles.

Stand of the Information: 10/01



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