

Sintering instruction

DD medical zirconia



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Sintering instruction

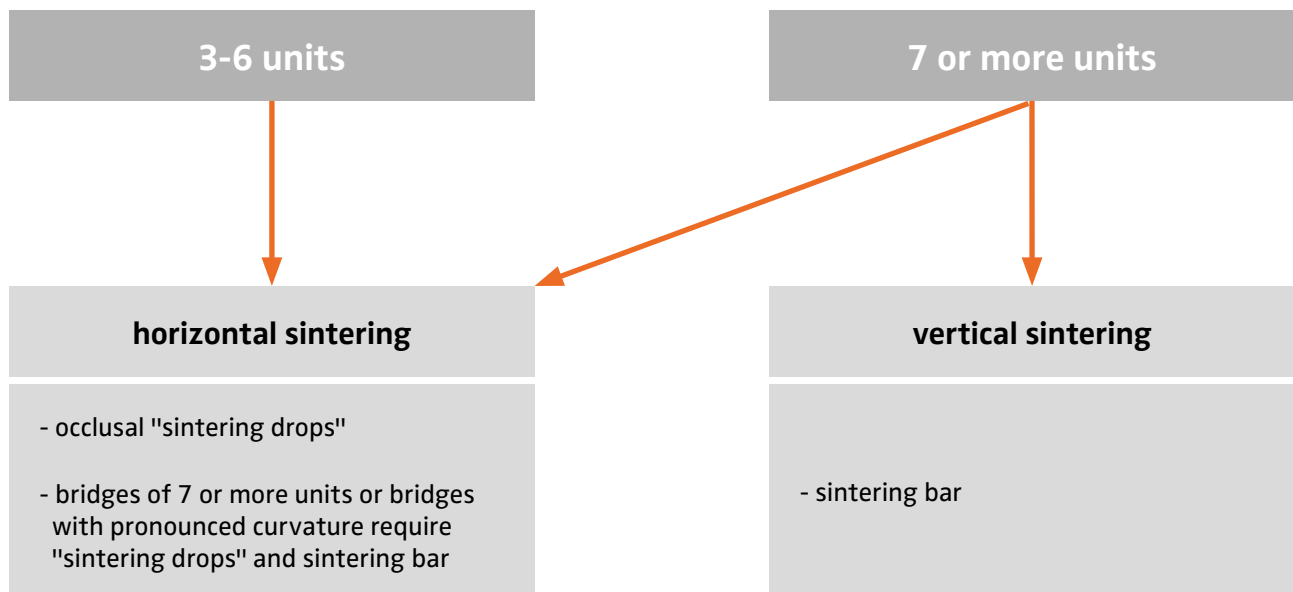
The listed sintering curves are matched to our zirconium dioxide materials. In the following we present you our recommendations for optimal sintering results. As a measurement of the actual temperature in each furnace can lead to different results, adjustments of individual furnace parameters through trial firing with PTC rings may be necessary in individual cases. We will be more than happy to advise you in this regard.

Download Sinterguide: <https://www.dentaldirekt.de/en/downloads>

Dental restorations made of zirconium dioxide should be sintered in a sintering furnace which is only used for these products. Sintering restorations made of another ceramic material or sintering of flow ceramics in the same sintering furnace can lead to impairment of sintering behavior or local discolorations.

1. RECOMMENDATION PRIOR TO SINTERING

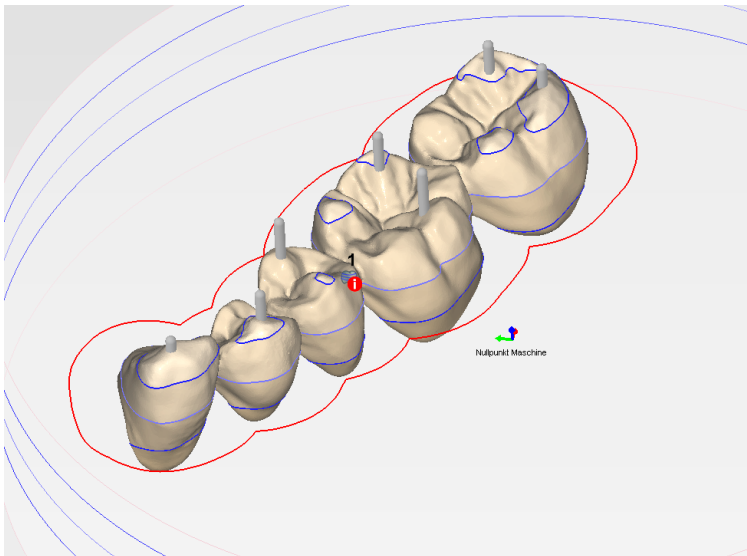
Sintering support for bridge restorations



1.1 "Sintering drops"

The drops are used to stabilize constructions during the horizontal sintering process. At least four drops must be placed on the occlusal surface to provide secure support for the constructions.

- Single crowns and anterior bridges with three units don't require drops. Posterior bridges up to 6 units should always be designed with drops.
- Occlusal sintering drops should be placed on anterior and posterior bridges with 7 or more units using the horizontal sintering technique.
- End units should always have drops.
- Every second unit should be constructed with sintering drops to ensure static support.
- Drops must be attached alternating in oral and vestibular region. The drops should not be placed directly on the edge of the occlusal surface.



Example for sintering drops on 5-unit bridge



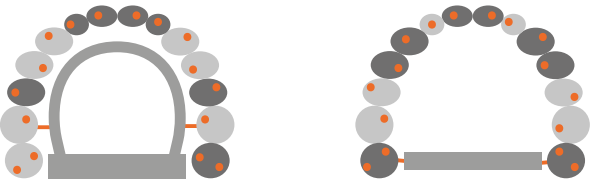
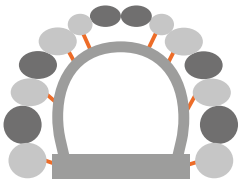
1.2 Preparing a sintering holder/bar in the CAM software

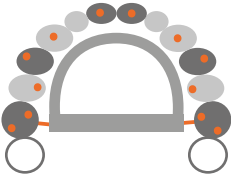
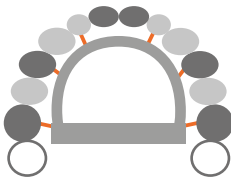
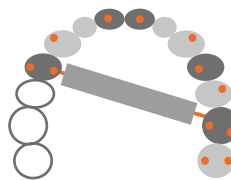
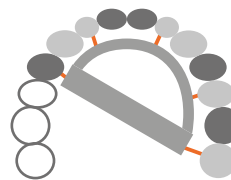
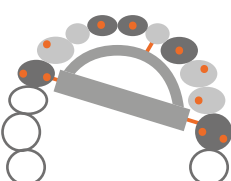
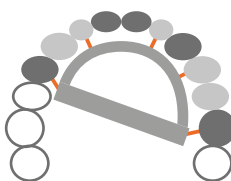
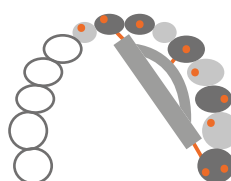
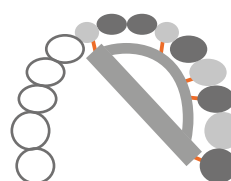
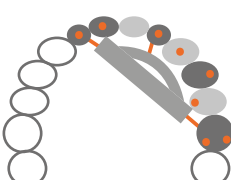
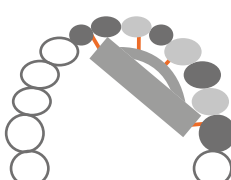
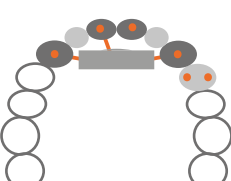
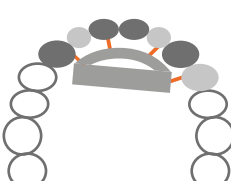




Not valid for DD cubeX²® (ML)

To avoid distortion and fitting problems with large-span zirconium dioxide bridges of 7 units or bridges with a strong curvature, it is essential to work with a support structure in the CAM software.

There are two options:

| Horizontal sintering | | Vertical sintering | |
|--|---|---|---|
| <p>For horizontal sintering, work with occlusal sintering drops and sintering bar, following the dental arch or bar shape.</p> |  | <p>For vertical sintering use a sintering bar, following the dental arch.</p> |  |
| Tips: | | | |
| <ul style="list-style-type: none"> Preferably place inner (oral) support bars on massive units, comparable end units (for sintered bars in bar shape) |  | | <ul style="list-style-type: none"> Preferably place inner (oral) support bars on massive units or alternatively at statically sensible intervals (at least every third unit) |
| <ul style="list-style-type: none"> For symmetrical restorations, place support bars at the end For asymmetrical restorations, place an additional support bar in the dental arch |  | | <ul style="list-style-type: none"> Align the support bars with the supporting surface Sintering bar should be longer than the end units |
| <ul style="list-style-type: none"> Place the support bars on the equator to avoid undercuts Adapt the cross-sections of the support bars to the mass to be supported | | | |

| Situation | Horizontal sintering | Vertical sintering |
|-----------|---|---|
| 12 units |  |  |
| 11 units |  |  |
| 10 units |  |  |
| 9 units |  |  |
| 8 units |  |  |
| 7 units |  |  |

-  Pontic
-  Abutment crown
-  Sintering drops

1.3 Separation before sintering

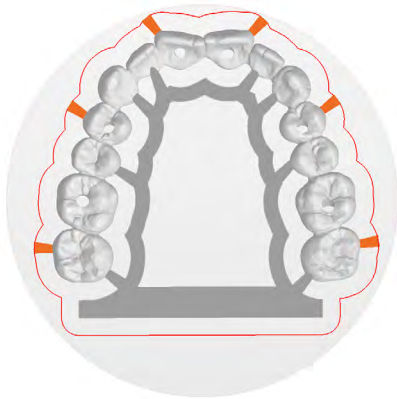
A dental handpiece or a turbine without water cooling is sufficient for this purpose; low contact pressure and well-cutting tools should be used. To avoid stress peaks and thus premature damage to the restoration due to material breakage, each support bar should only be cut halfway through.

The support bars can be reduced to a predetermined breaking point and cut through afterwards. The excess support bars can be ground down after the restoration has been carefully removed from the blank.

The inner (oral) support bars remain in place.

The supporting surface must be flat for vertical sintering.

Remove the support bars marked in orange.



1.4 Drying process when wet milling or grinding has been realized

In case of wet processing, a drying process should be realized in a ceramic furnace or fan-assisted oven* to remove coolant and/or lubricating fluid from the porous structure.

*This fan-assisted oven must not be used for the preparation of food.



Please note: User information „DD Bio ZS“ and „DD Bio ZX² 19“

<https://www.dentaldirekt.de/en/downloads>

DDBio^{ZS}

User information

After milling and before further processing the dental restorations should be cleaned from residue. Therefore you can carefully use water or steam. Afterwards it is necessary to dry the framework, to remove water and milling additives from the porous structure.

Drying process is required for an homogenous coloration of the framework by coloring liquid.



We recommend: Drying of restorations at 700 °C (for 5 min.)



Consult instructions for use
Rev. 01_2017/09



DDBio^{ZX²19}

User information

After milling and before further processing the dental restorations should be cleaned from residue. Therefore you can carefully use water or steam. Afterwards it is necessary to dry the framework, to remove water and milling additives from the porous structure.

Drying process is required for an homogenous coloration of the framework by coloring liquid.



We recommend: Drying of restorations at 80 °C (for 30 min.) or 150 °C (for 10 min.)



Consult instructions for use
Rev. 02_2017/07



1.5 Dyeing with DD Shade Concept®



Important: Do not color wet frames. Only completely dry restorations should be colored.

Please adhere to the specified drying times.



Please note:

Instruction for use „DD Shade Concept®“

<https://www.dentaldirekt.de/en/ifu>



1.6 Inspection of the milled restorations

- No material pitting
- No identifiable cracks
- No adhesion of zirconia dust (removal by means of compressed air, brush, and/or immersion in water followed by drying in fan-assisted oven)
- No surface discoloring
- No glossy patches on the surface

The construction should not be used for the manufacture of dental prostheses if one of the deficiencies listed is detected.

2. SINTERING PROCESS

2.1 General information

In addition to the use of the correct sintering program, including final temperature, dwell time and heating and cooling rates, the quality of sintered restorations can depend on:

- the firing capacity and chamber volume of the sintering furnace used
- the size and volume of individual constructions
- the mass in the firing chamber (auxiliary sintering media and quantity of constructions)

To achieve ideal results a sintering program should be selected that heats up all the constructions in the sintering furnace uniformly. Local differences in sintering caused by heating too rapidly can lead to warping and the formation of cracks. This effect is particularly observed in the case of long-span and solid bridges.

When your sintering furnace is loaded with numerous parts and additional elements such as hoods or similar the thermal energy may, depending on the sintering furnace type involved, prove inadequate to ensure flawless sintering of all the parts. Sintering without a cover can improve the light-optical properties.

We therefore recommend sintering the zirconium dioxide constructions without a cover!



General rule:

If possible, a sintering program with slower sintering cycle should be preferred to a speed sintering program.

2.2 Final firing temperatures

All mentioned temperatures are recommendations.

The actual temperatures varies from sintering furnace to sintering furnace.

An opaque result can be an indication of a wrong sintering furnace temperature.

| | |
|--------------------------------|-------------------|
| DD cubeX ² ® (ML) | <h1>1.450 °C</h1> |
| DD cubeY® HL | |
| DD cube ONE® (ML) | |
| DD Bio ZX ² (color) | |
| DD Bio ZW iso (color) | |
| Nacera® Pearl Natural | <h1>1.500 °C</h1> |



Important:

Do not place milled restorations in the sintering furnace when the maximum residual temperature is greater than 70°C, due to the danger of temperature shock.

Never open the sintering furnace door at a temperature exceeding 200°C to protect the heating elements (exception: speed and superspeed programs).

2.3 Overview sintering programs of Dental Direkt zirconia

| Material | For use for* | | | | | Sintering furnace filling | | Sintering program | | | | | | °C | Time (h) | |
|--------------------------------|---|---|--|---|--|---|--|-------------------|---------|--------------------------------|-------------------------------|--|-------------------------------------|-----|----------|--|
| | fully anatomical (monolithic) and anatomically reduced crowns | fully anatomical (monolithic) bridges up to 7 units without sintering support structures and sintering pearls | fully anatomical (monolithic) bridges and anatomically reduced bridges up to 3 units | massive fully anatomical (monolithic) and anatomically reduced crowns with sintering pearls | massive fully anatomical (monolithic) bridges and anatomically reduced bridges up to 3 units and/or sintering pearls | LOW (without cover and sintering pearls) sintering with 1 level | HIGH (without cover) sintering with 2 or more levels | Standard | Massive | Nacera® Pearl Natural Standard | Nacera® Pearl Natural Massive | Speed sintering with Dekema furnaces 664 and 674 | Speed sintering with Mihm Vogt mv-r | | | Superspeed sintering with Mihm Vogt mv-r |
| DD cubeX ² ® (ML) | ● | | ● | | | ● | | ● | | | | | | | 1.450 | 9 |
| | ● | | ● | ● | ● | | ● | ● | | | | | | | | 11 |
| | ● | | ● | | ● | ● | | | | | | ● | ●** | ●** | | < 2,5 |
| DD cubeY® HL | ● | ● | ● | | | ● | | ● | | | | | | | 1.450 | 9 |
| | ● | ● | ● | ● | ● | | ● | ● | | | | | | | | 11 |
| | ● | | | | | ● | | | | | | ● | | | | < 2,5 |
| DD cube ONE® (ML) | ● | ● | ● | | | ● | | ● | | | | | | | 1.450 | 9 |
| | ● | ● | ● | ● | ● | | ● | ● | | | | | | | | 11 |
| | ● | | | | | ● | | | | | | ● | | | | < 2,5 |
| DD Bio ZX ² (color) | ● | ● | ● | | | ● | | ● | | | | | | | 1.450 | 9 |
| | ● | ● | ● | ● | ● | | ● | ● | | | | | | | | 11 |
| | ● | | | | | ● | | | | | | ● | | | | < 2,5 |
| DD Bio ZW iso (color) | ● | ● | ● | | | ● | | ● | | | | | | | 1.450 | 9 |
| | ● | ● | ● | ● | ● | | ● | ● | | | | | | | | 11 |
| | ● | | | | | ● | | | | | | ● | | | | < 2,5 |
| Nacera® Pearl Natural | ● | ● | ● | | | ● | | | | ● | | | | | 1.500 | 8 |
| | ● | ● | ● | ● | ● | | ● | | | | ● | | | | | 14 |
| | ● | | | | | ● | | | | | | ● | | | | 1,5 |

* Please refer to our separate instructions for use for more detailed information on the indicated indications.

**Only DD cubeX® ML in all 16 VITA®-shades!

2.4 Sintering programs for the product variants DD cubeX²® (ML), DD cubeY® HL, DD cube ONE® (ML), DD Bio ZX² (color), DD Bio ZW iso (color)

Standard program:

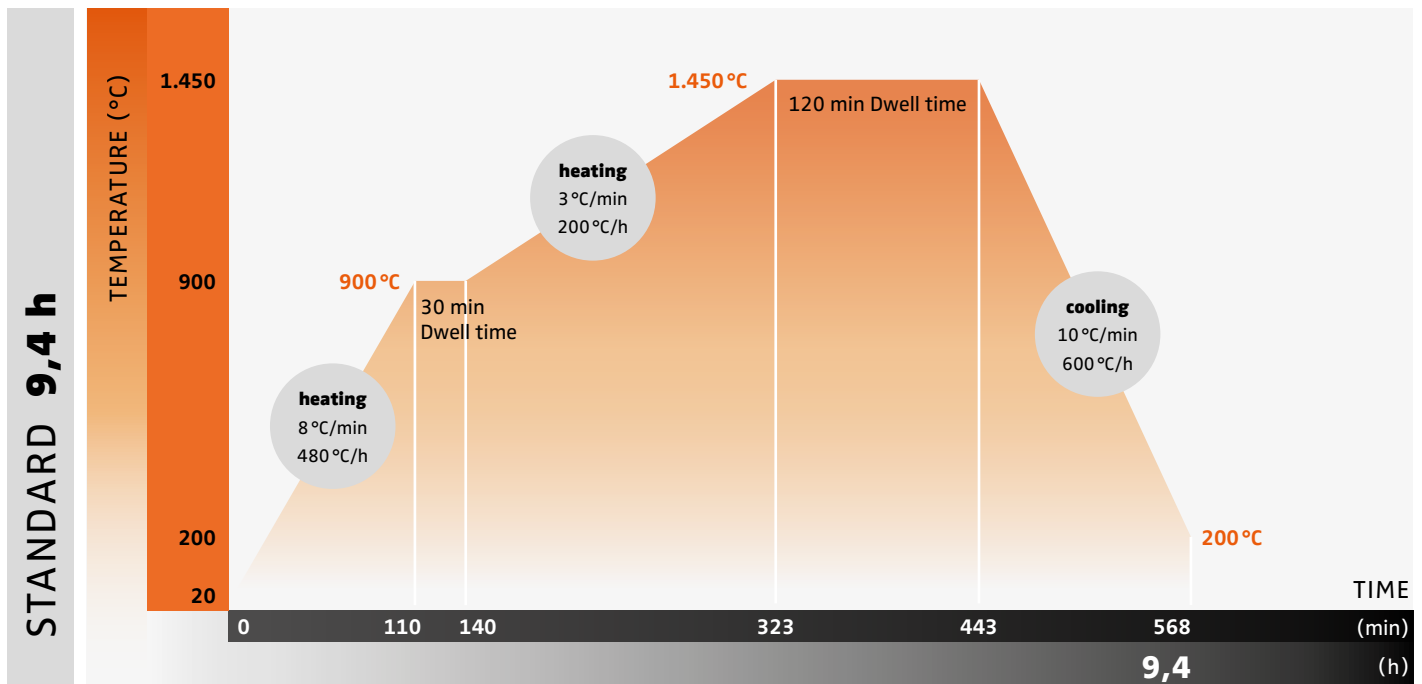
Maximum temperature 1.450 °C / Duration ~ 9 h

For fully anatomical (monolithic) crowns, anatomically reduced crowns, fully anatomical (monolithic) bridges and anatomically reduced bridges up to 6 units **without sintering support structures and sintering pearls**

Sintering furnace filling: Low to medium (without cover, sintering pearls and second sintering level)

| „Classic“-entry | C0 L0 T008.A900 L9 T1800 T003.C1450 T7200 T010.C200 C0 L0 T2 | | | | | |
|----------------------|--|--------------|---------------------|-----------------------|------------------|--------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/h] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 900 | 480 | 8 | – | 110 |
| Dwell | 900 | 900 | – | – | 30 | 30 |
| Heating | 900 | 1.450 | 200 | 3 | – | 183 |
| Dwell | 1.450 | 1.450 | – | – | 120 | 120 |
| Cooling* | 1.450 | 200 | 600 | 10 | – | 125 |
| Total time: | | | | | | 568 min 9,4 h |

* **Alternative:** Uncontrolled cooling by turning off the heating. Do not open the sintering furnace before 200 °C.



Massive program:

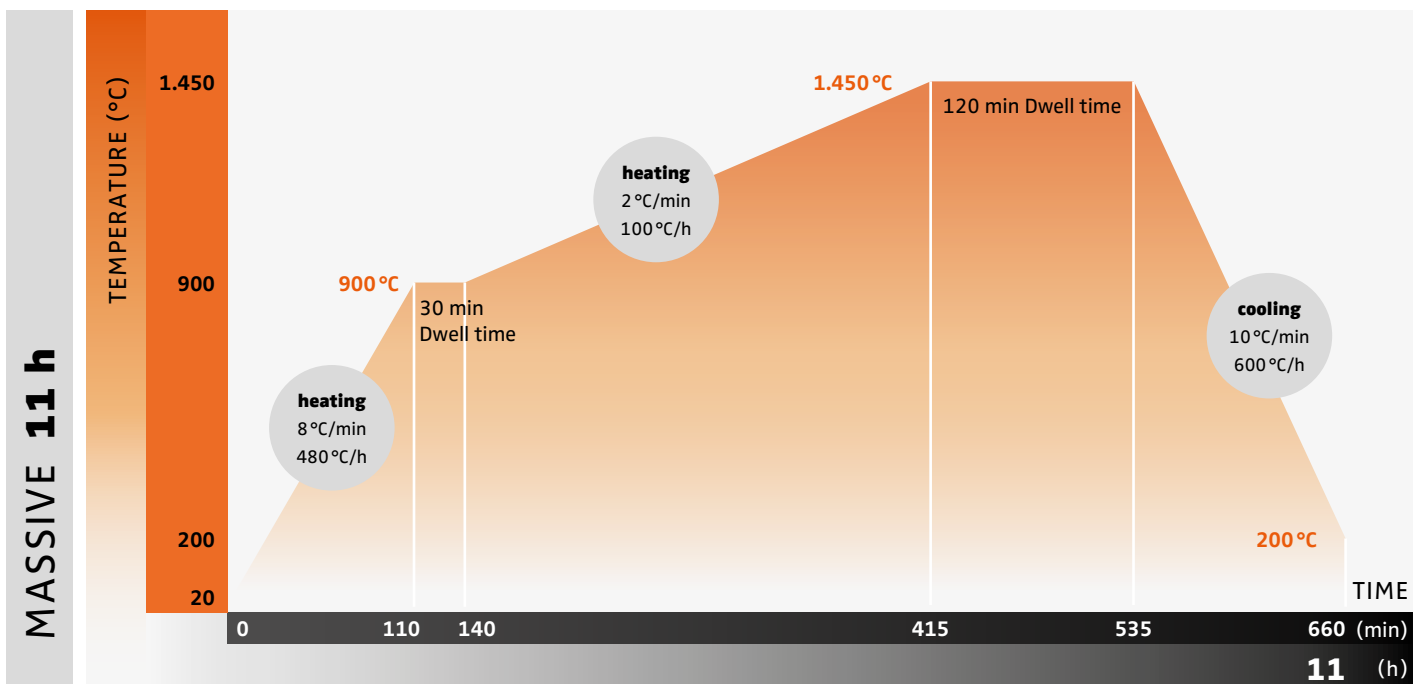
Maximum temperature 1.450 °C / Duration ~ 11 h

For massive fully anatomical (monolithic) crowns and anatomically reduced crowns, massive fully anatomical (monolithic) bridges and anatomically reduced bridges **with sintering support structures** (e.g. blank segment, sintering pearls)

Sintering furnace filling: High (without cover)

| „Classic“-entry | C0 L0 T008.A900 L9 T1800 T002.C1450 T7200 T010.C200 C0 L0 T2 | | | | | |
|----------------------|--|--------------|---------------------|-----------------------|------------------|-------------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/h] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 900 | 480 | 8 | – | 110 |
| Dwell | 900 | 900 | – | – | 30 | 30 |
| Heating | 900 | 1.450 | 100 | 2 | – | 275 |
| Dwell | 1.450 | 1.450 | – | – | 120 | 120 |
| Cooling* | 1.450 | 200 | 600 | 10 | – | 125 |
| Total time: | | | | | | 660 min 11 h |

* **Alternative:** Uncontrolled cooling by turning off the heating. Do not open the sintering furnace before 200°C.



Speed sintering programs for Dekema furnaces:

Maximum temperature 1.450 °C –

only for single crowns with maximum material thickness 4 mm

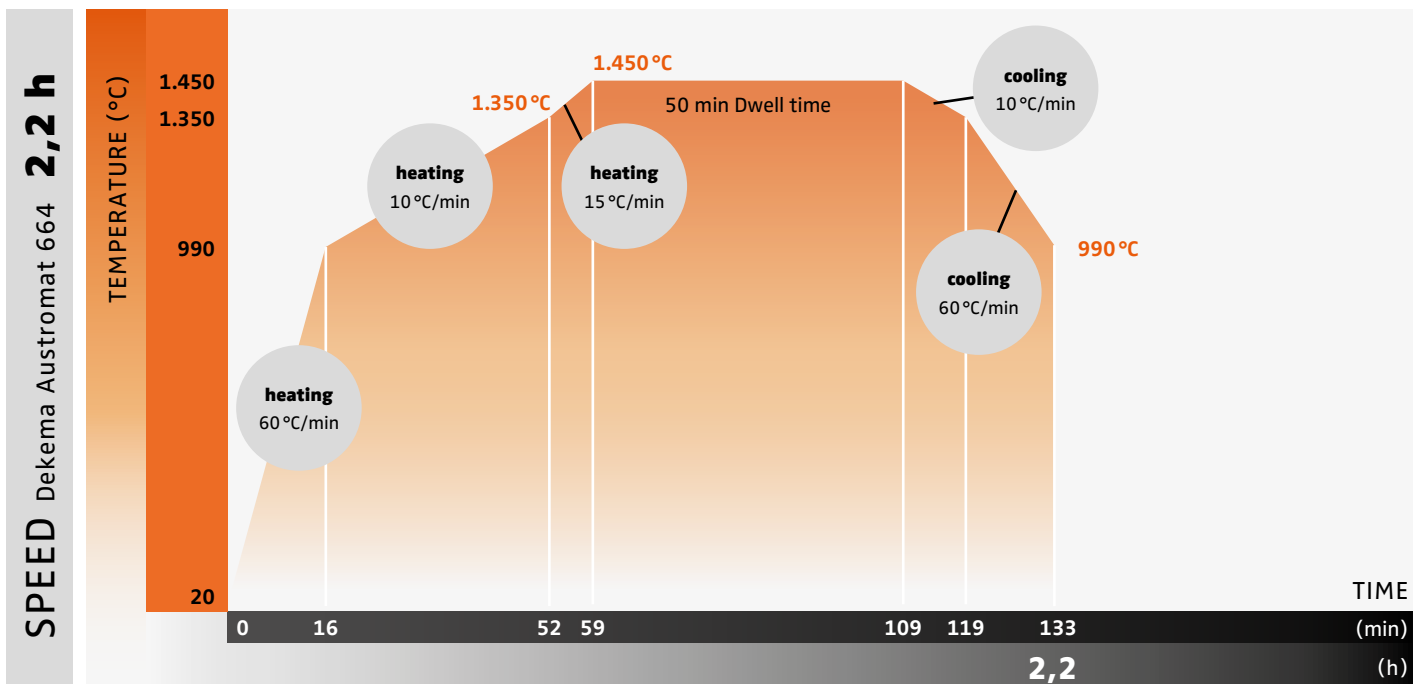
Dekema Austromat 664 (DD Argus fire speed)

Furnace filling: Sintering only on one plane, maximum 3 crowns per sintering process

| „Classic“-entry | C0 L0 T060.A990 L9 T010.C1350 T015.C1450 T3000 T010.C1350 C990 C0 L0 T2 | | | | | |
|----------------------|---|--------------|-----------------------|------------------|----------------------------|------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/min] | Dwell time [min] | Furnace lift position | Time [min] |
| Heating | 20 | 990 | 60 | – | closed completely | 16 |
| | 990 | 1.350 | 10 | – | – | 36 |
| | 1.350 | 1.450 | 15 | – | – | 7 |
| Dwell | 1.450 | 1.450 | – | 50 | – | 50 |
| | 1.450 | 1.350 | 10 | – | – | 10 |
| Cooling | 1.350 | 200 | 60 | – | At 990°C opened completely | 14* |
| | Total time: | | | | | |

* time until completely open at 990 °C

Attention: The use of speed programs leads to minimal, but not significant deviations in color, translucency and mechanical properties. The specified speed sintering cycles were validated in the Dekema Austromat 664/674 sintering furnaces mentioned above. The use of programs in other sintering furnaces may lead to deviating results, in regard of color and translucency of the constructions. This is among other reasons due to different chamber volume.



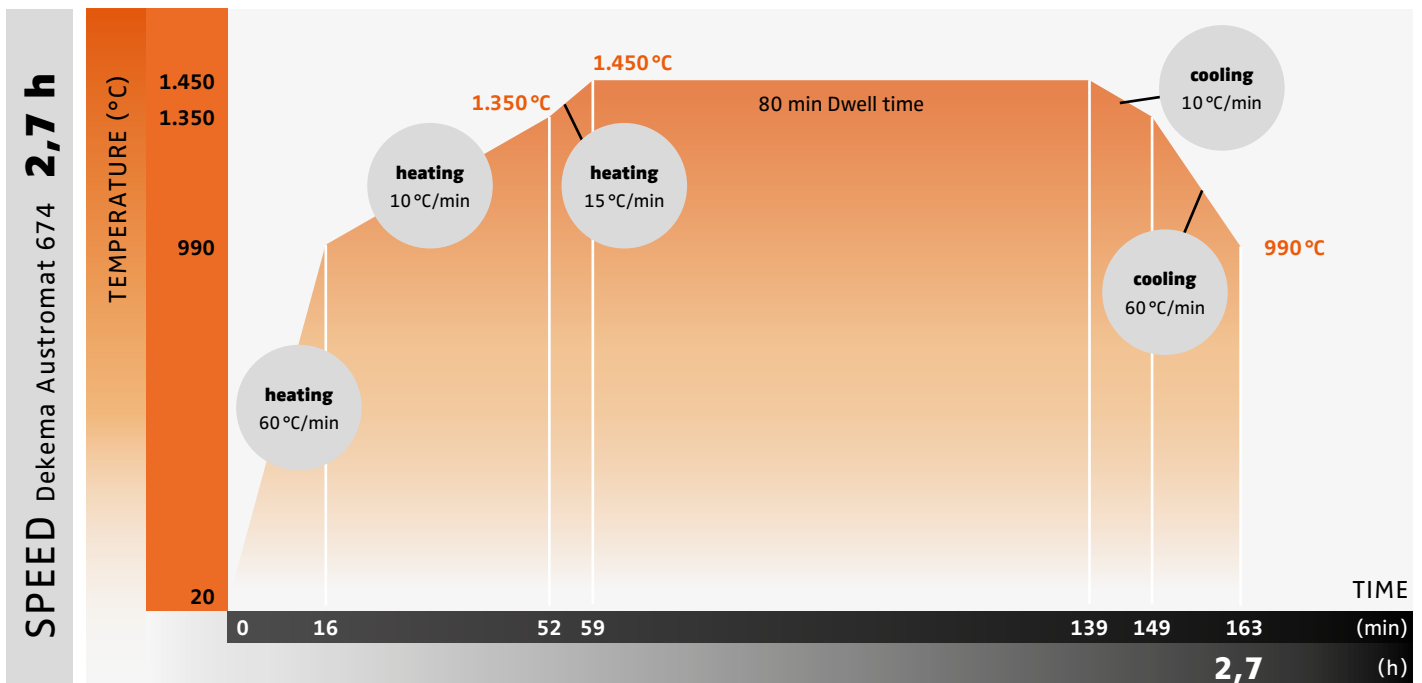
Dekema Austromat 674 (DD Argus fire 674)

Sintering furnace filling: Sintering only on one plane, maximum 6 crowns per sintering process

| „Classic“-entry | C0 L0 T060.A990 L9 T010.C1350 T015.C1450 T4800 T010.C1350 C990 C0 L0 T2 | | | | | |
|----------------------|---|--------------|-----------------------|------------------|----------------------------|--------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/min] | Dwell time [min] | Furnace lift position | Time [min] |
| Heating | 20 | 990 | 60 | – | closed completely | 16 |
| | 990 | 1.350 | 10 | – | – | 36 |
| | 1.350 | 1.450 | 15 | – | – | 7 |
| Dwell | 1.450 | 1.450 | – | 80 | – | 80 |
| Cooling | 1.450 | 1.350 | 10 | – | – | 10 |
| | 1.350 | 200 | 60 | – | At 990°C opened completely | 14* |
| | | | | | Total time: | 163 min 2,7 h |

* time until completely open at 990 °C

Attention: The use of speed programs leads to minimal, but not significant deviations in color, translucency and mechanical properties. The specified speed sintering cycles were validated in the Dekema Austromat 664/674 furnaces mentioned above. The use of programs in other sintering furnaces may lead to deviating results, in regard of color and translucency of the constructions. This is among other reasons due to different chamber volume.



2.5 Speed and superspeed sintering programs with the sintering furnace mv-r from Mihm-Vogt for DD cubeX²® ML



Procedure: For optimum sintering results in the DD Speed and DD Superspeed programs, the sintering furnace must be started at room temperature. It is to be sintered with the standard program mode (heating rate up to 120 °C/minute or 216 °F/minute, respectively). The sintering firings are carried out with the SiC tray.

After sintering, the SiC sintering tray can be removed with crucible tongs at 750°C or lower, which should be done focused and quickly! The tray must be placed on a heat-resistant, insulating base (e. g. support fleece 100). The restorations can then be picked up with the tongs and placed onto another heat-resistant base for faster cooling, e. g. the sintering material support 40/12. After approx. 10 minutes the restoration has cooled down and can be processed further. Do not cool down with water or compressed air, as this will considerably shorten the lifetime of the restoration! The tongs may scorch when the tray is removed, but they can still be used. To protect the furnace, close the furnace after removal.



The programs are validated only for the sintering furnace mv-r!

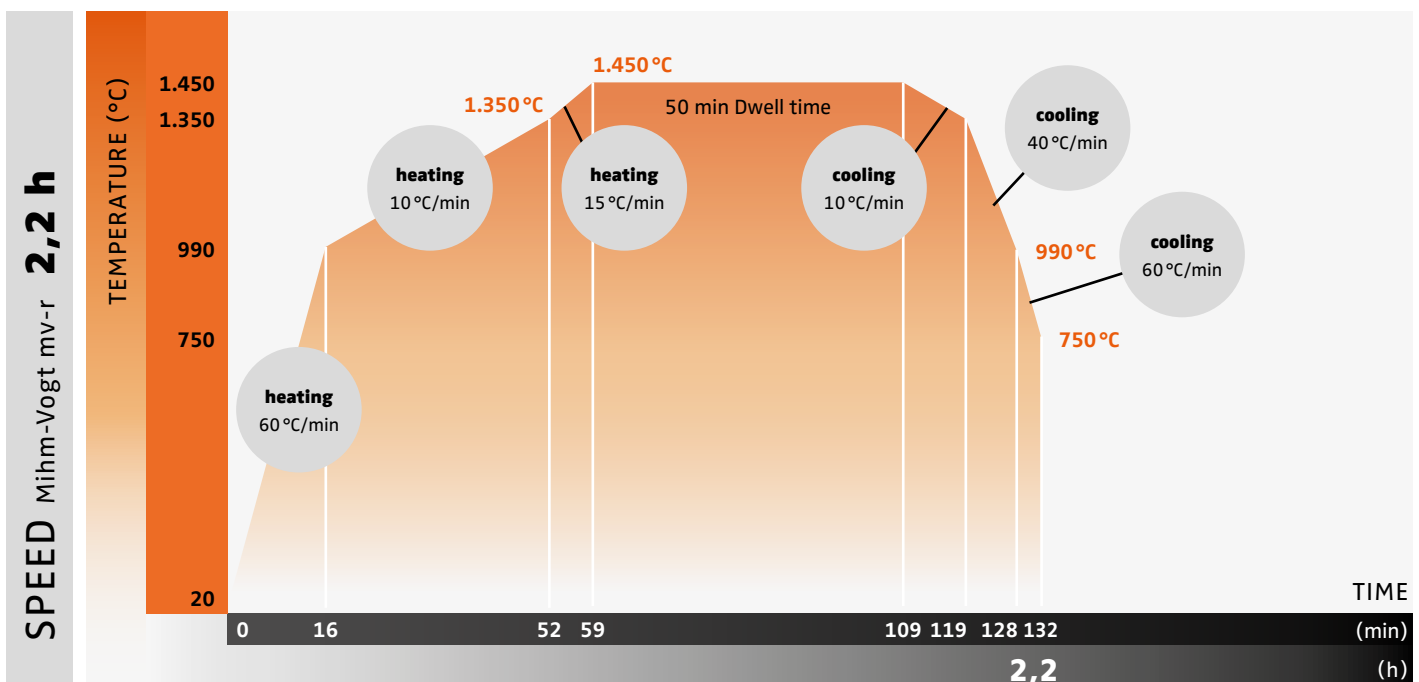
Speed sintering with the sintering furnace mv-r from Mihm-Vogt:

Furnace loading: One 3-unit bridge or up to 6 single crowns

Limitation of the approved materials: Only **DD cubeX[®] ML** in all 16 VITA[®]-shades!

| Program mode | Standard program mode (sintering up to 120°C/min with sintering tray) | | | | |
|--------------|---|--------------|-----------------------|--------------------|--------------------------|
| | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 990 | 60 | – | 16 |
| | 990 | 1.350 | 10 | – | 36 |
| | 1.350 | 1.450 | 15 | – | 7 |
| Dwell | 1.450 | 1.450 | – | 50 | 50 |
| Cooling | 1.450 | 1.350 | 10 | – | 10 |
| | 1.350 | 990 | 40 | – | 9 |
| | 990 | 750 | 60 | – | 4 |
| | | | | Total time: | 132 min 2,2 h |

The use of the speed program leads to minimal, but not significant deviation in color, translucency and mechanical properties.



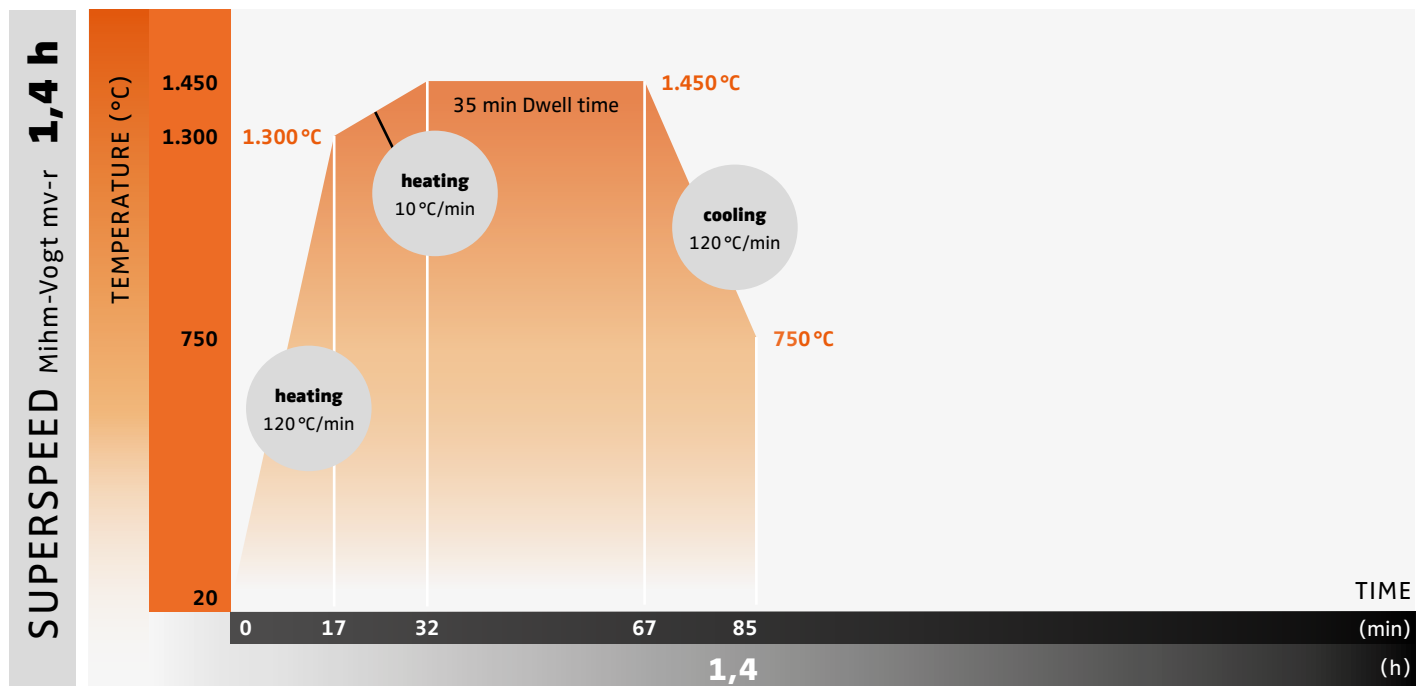
Superspeed sintering with the mv-r sintering furnace from Mihm-Vogt:

Furnace filling: Up to 3 single crowns per sintering process (up to 2 mm material thickness)

Limitation of the approved materials: Only **DD cubeX® ML** in all 16 VITA-colors!

| Program mode | Standard program mode (sintering with sintering tray up to 120°C/min) | | | | |
|--------------|---|--------------|-----------------------|--------------------|-------------------------|
| | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 1.300 | 120 | – | 17 |
| | 1.300 | 1.450 | 10 | – | 15 |
| Dwell | 1.450 | 1.450 | – | 35 | 35 |
| Cooling | 1.450 | 750 | 120 | – | 18 |
| | | | | Total time: | 85 min 1,4 h |

The use of the superspeed program leads to minimal, but not significant deviation in color, translucency and mechanical properties.



2.6 Sintering programs for the product variant Nacera® Pearl Natural

Nacera® Pearl Natural Standard program:

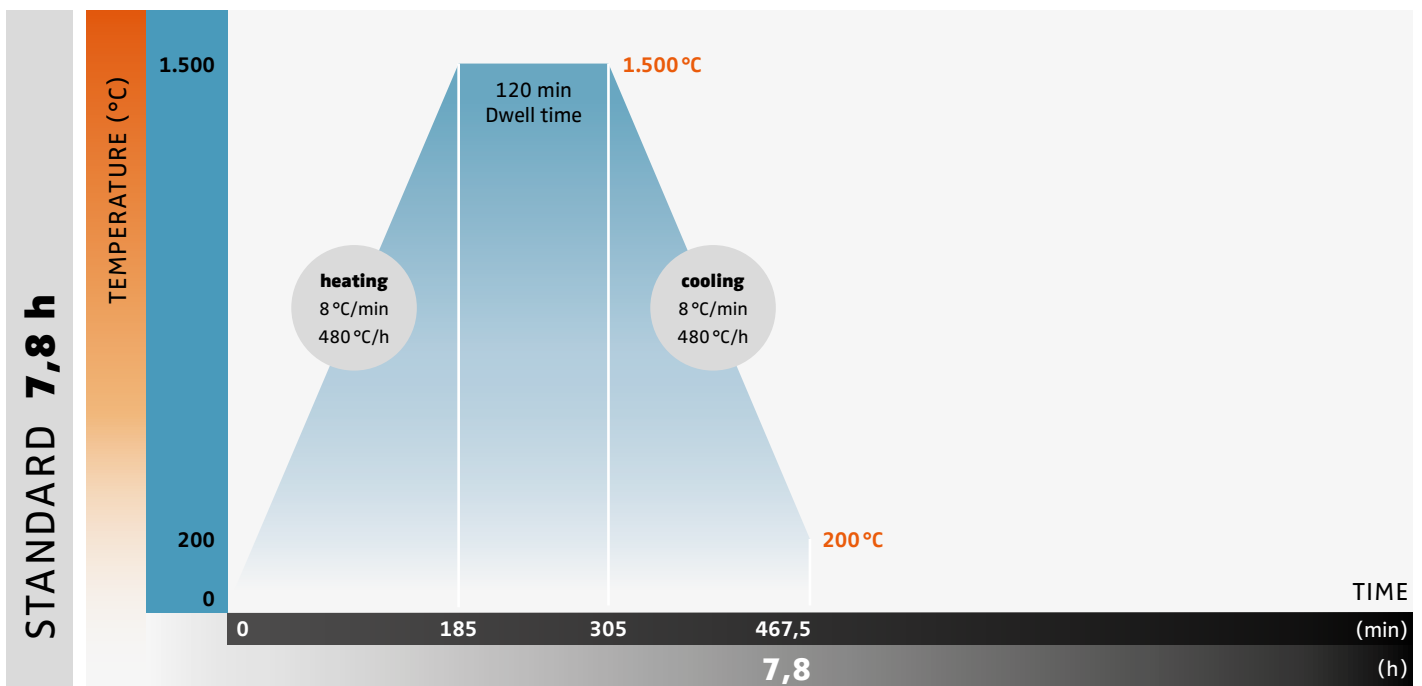
Maximum temperature 1.500 °C / Duration ~ 8 h

For fully anatomical (monolithic) crowns, anatomically reduced crowns, fully anatomical (monolithic) bridges and anatomically reduced bridges up to 6 units **without sintering support structures and sintering pearls**

Furnace filling: Low to medium (without cover; without sintering pearls)

| „Classic“-entry | C0 L0 T008.C1500 L9 T7200 T08.C200 C0 L0 T2 | | | | | |
|----------------------|---|--------------|---------------------|-----------------------|------------------|----------------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/h] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 1.500 | 480 | 8 | – | 185 |
| Dwell | 1.500 | 1.500 | – | – | 120 | 120 |
| Cooling* | 1.500 | 200 | 480 | 8 | – | 162,5 |
| Total time: | | | | | | 467,5 min 7,8 h |

* **Alternative:** Uncontrolled cooling by turning off the heating. Do not open the sintering furnace before 200°C.



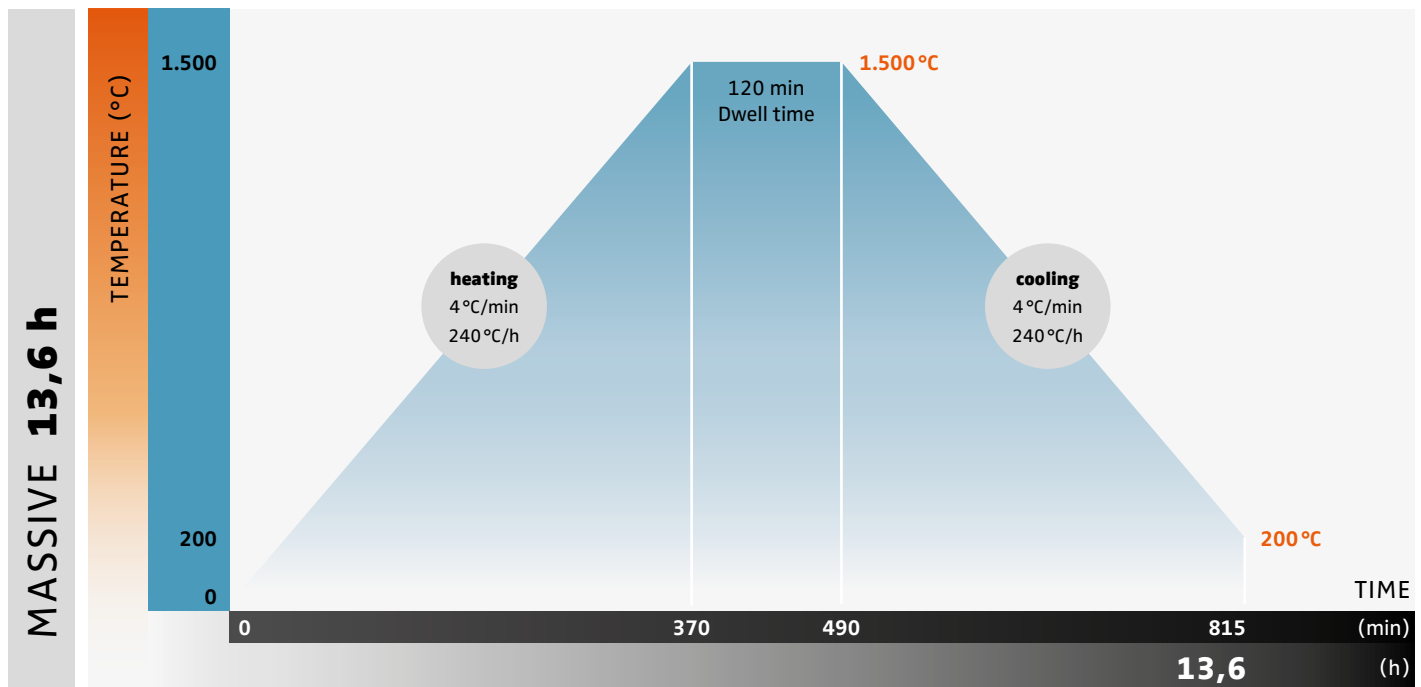
Nacera® Pearl Natural Massive program: Maximum temperature 1.500 °C / Duration ~ 14 h

For massive fully anatomical (monolithic) crowns and anatomically reduced crowns, massive fully anatomical (monolithic) bridges and anatomically reduced bridges **with sintering support structures** (e.g. blank segment, sintering pearls)

Furnace filling: High

| „Classic“-entry | C0 L0 T004.C1500 L9 T7200 T04.C200 C0 L0 T2 | | | | | |
|----------------------|---|--------------|---------------------|-----------------------|--------------------|---------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/h] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 1.500 | 240 | 4 | – | 370 |
| Dwell | 1.500 | 1.500 | – | – | 120 | 120 |
| Cooling* | 1.500 | 200 | 240 | 4 | – | 325 |
| | | | | | Total time: | 815 min 13,6 h |

* **Alternative:** Uncontrolled cooling by turning off the heating. Do not open the sintering furnace before 200°C.



Nacera® Pearl Natural Speed sintering program:

Maximum temperature 1.530 °C

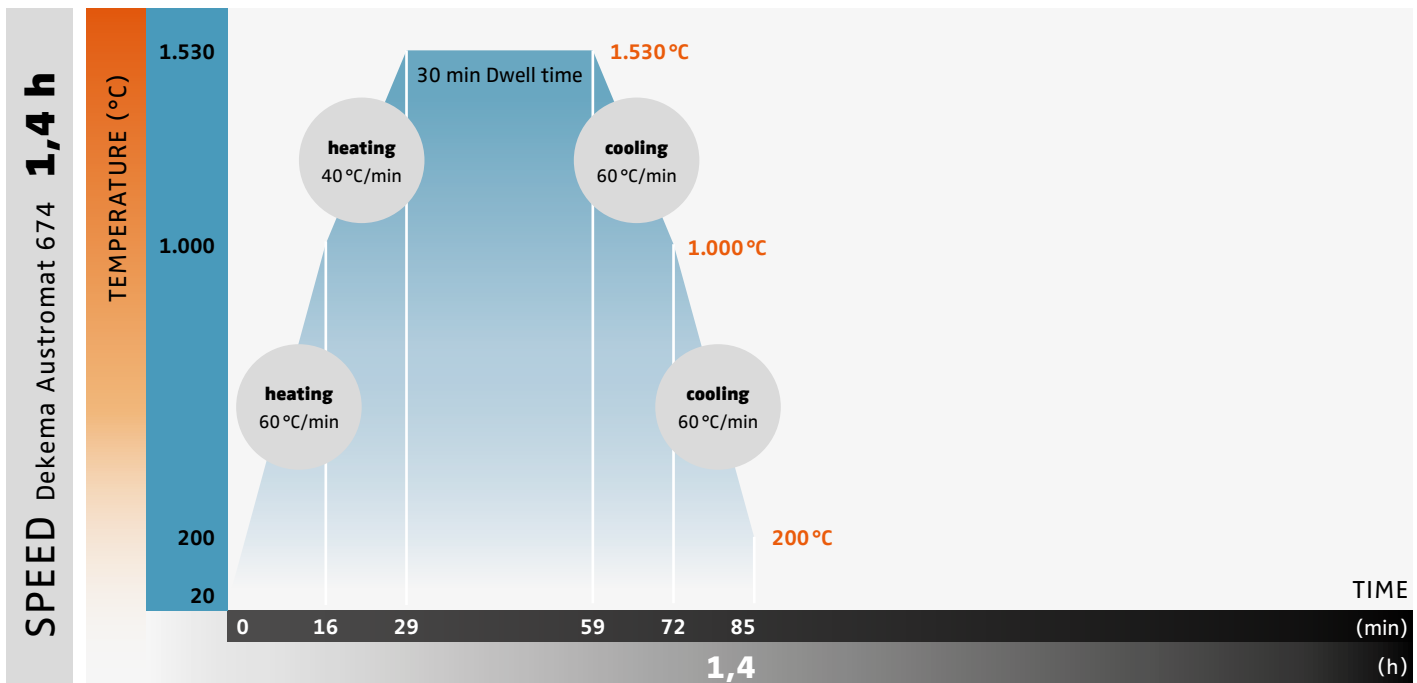
Only for single crowns with max. material thickness of 2 mm

Dekema Austromat 674 (DD Argus fire 674)

Furnace filling: Sintering only with one level, max. 16 single crowns per sintering cycle

| „Classic“-entry | C0 L0 T060.A1000 L9 T040.C1530 T1800 T040.C1000 T060.C200 C0 L0 T2 | | | | |
|----------------------|--|--------------|-----------------------|------------------|-------------------------|
| „Professional“-entry | Temp. 1 [°C] | Temp. 2 [°C] | Heating rate [°C/min] | Dwell time [min] | Time [min] |
| Heating | 20 | 1.000 | 60 | – | 16 |
| | 1.000 | 1.530 | 40 | – | 13 |
| Dwell | 1.530 | 1.530 | – | 30 | 30 |
| Cooling | 1.530 | 1.000 | 40 | – | 13 |
| | 1.000 | 200 | 60 | – | 13 |
| Total time: | | | | | 85 min 1,4 h |

Attention: The use of speed programs leads to minimal, but not significant deviations in color, translucency and mechanical properties. The specified speed sintering cycles were validated in the Dekema Austromat 674 sintering furnace mentioned above. The use of programs in other sintering furnaces may lead to deviating results, in regard of color and translucency of the constructions. This is among other reasons due to different chamber volume.



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This version replaces all previous versions.



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