

# IPS<sup>®</sup> e.max<sup>®</sup> ZirCAD



all ceramic  
all you need

INSTRUCTIONS FOR USE

CE 0123

ivoclar  
vivadent<sup>®</sup>  
technical

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# IPS e.max® System – all you need

## IPS e.max – one system for every indication

IPS e.max is an innovative all-ceramic system which covers the entire all-ceramic indication range – from Thin Veneers to 12-unit bridges.

IPS e.max delivers high-strength and highly esthetic materials for the Press and the CAD/CAM technologies. The system consists of innovative lithium disilicate glass-ceramics used mainly for single-tooth restorations and high-strength zirconium oxide for multi-unit bridges.

Every patient situation presents its own requirements and objectives. IPS e.max meets these requirements, because due to the system components you obtain exactly what you need.

- The components for the Press technology include the highly esthetic IPS e.max Press lithium disilicate glass-ceramic ingots and the IPS e.max ZirPress fluorapatite glass-ceramic ingots for the fast and efficient press-on-zirconia technique.
- Depending on the case requirements, two types of materials are available for the CAD/CAM technique: the innovative IPS e.max CAD lithium disilicate glass-ceramic blocks and the IPS e.max ZirCAD high-strength zirconium oxide.
- The nano-fluorapatite layering ceramic IPS e.max Ceram, which is used to characterize/veneer all IPS e.max components – glass or oxide ceramics –, complete the IPS e.max system.

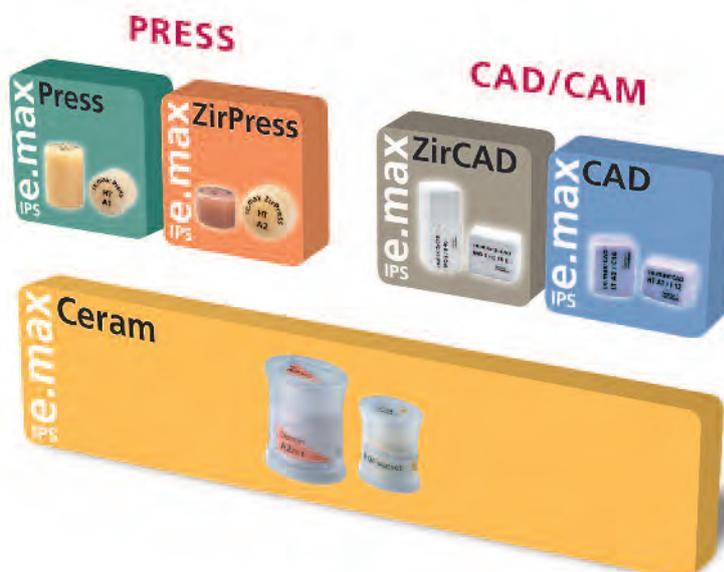
## IPS e.max ZirCAD

IPS e.max ZirCAD is ideal for indications that require high strength, such as anterior and posterior bridges. The zirconium oxide material is processed by means of the CAD/CAM technique. The framework is milled to contour approximately 20-25% larger than required and subsequently sintered in the Sintramat or Programat S1 high-temperature furnace. During sintering, the framework shrinks to its final size and obtains its typical, high fracture toughness as a result of the homogeneous structure. After that, IPS e.max ZirCAD frameworks are conventionally veneered using the IPS e.max Ceram layering ceramic or pressed over using the IPS e.max ZirPress fluorapatite ingots.

IPS e.max ZirCAD is available in nine block sizes and three shades (MO 0, MO 1, MO 2). The smaller blocks are used for single copings, the larger ones for multi-unit bridge frameworks or for stack milling. With the use of pre-shaded blocks (MO 1 and MO 2) or colouring liquids, excess brightness or white borders in the transition area to the gingiva, for example, can be prevented.

Combination cases are particularly demanding. Therefore, the shade concept of the IPS e.max ZirCAD blocks has been adjusted to that of IPS e.max Press MO and IPS e.max CAD MO.

In this way, an optimum shade base is created irrespective of the IPS e.max framework material used (lithium disilicate or zirconium oxide), which optimally supports the esthetic result of the veneering materials.



# IPS e.max® ZirCAD – Product Information

## Material

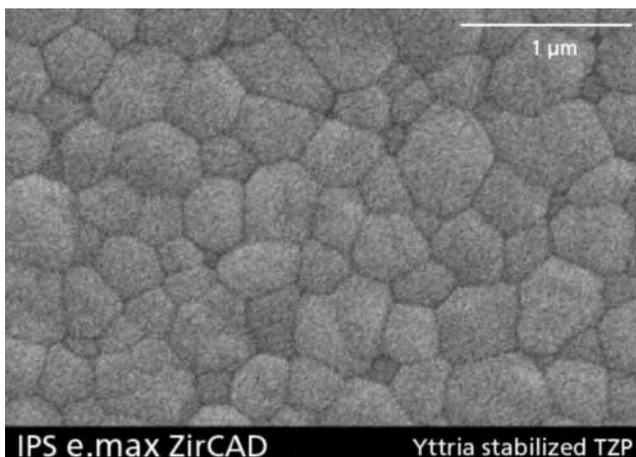
IPS e.max ZirCAD are pre-sintered yttrium-stabilized zirconium oxide blocks for the CAD/CAM technology. The blocks are available both shaded and unshaded. After sintering to full density, the material forms a polycrystalline oxide ceramic material made up



of tetragonal zirconium oxide polycrystals (TZP).

With a flexural strength of more than 900 MPa, the material demonstrates a high fracture resistance and its fracture toughness is more than twice that of glass-infiltrated ceramic. IPS e.max ZirCAD can be processed very easily in a CAD/CAM unit in its partly sintered, “chalk-like” state. Milling is always carried out with an enlargement of the framework of approximately 20–25 % per spatial axis. Given the controlled manufacturing process of the blocks, combined with an optimized sintering process in a high-temperature furnace from Ivoclar Vivadent, the shrinkage of the slightly enlarged, milled frameworks can be controlled in such a way that excellent accuracy of fit can be achieved. During the sintering procedure, the final, material-specific properties of the TZP are achieved. In the process, a structure that is densified to more than 99% is created, which features a high fracture resistance combined with high fracture toughness and thus fully meets the clinical requirements presented by masticatory forces – particularly in the posterior region.

Therefore, IPS e.max ZirCAD supplements the range of indications of the IPS e.max materials in an ideal fashion. Either IPS e.max ZirPress is pressed onto the high-strength IPS e.max ZirCAD frameworks and/or the framework is veneered using IPS e.max Ceram.



CTE (100-400°C) [10 <sup>-6</sup> /K]	10.8
CTE (100-500°C) [10 <sup>-6</sup> /K]	10.8
Flexural strength (biaxial) [MPa]*	900
Fracture toughness [MPa m <sup>0.5</sup> ]	5.5
Vickers hardness [MPa]	13000
Chem. solubility [µg/cm <sup>2</sup> ]*	1
Sinter temperature [°C/°F]	1500/2732

\*according to ISO6872

## Uses

### Indications

- Crown frameworks for anterior and posterior restorations
- 3- to 12-unit bridge frameworks for the anterior and posterior regions
- Inlay bridge frameworks
- Primary telescope crowns
- Implant superstructures (single-tooth and bridge frameworks)
- Interlocked crown frameworks

### Contraindications

- More than two connected pontics
- Very deep sub-gingival preparations
- Patients with substantially reduced residual dentition
- Bruxism
- Any other use not listed in the indications

### Important processing restrictions

Failure to observe the following restrictions may compromise the results achieved with IPS e.max ZirCAD:

- Failure to observe the necessary minimum connector and framework thicknesses
- Veneering of IPS e.max ZirCAD frameworks without IPS e.max Ceram ZirLiner
- Milling the blocks with non-compatible CAD/CAM systems.
- Sintering in a non-compatible sinter furnace

### Side effects

If the patient is known to be allergic to any of the components of IPS e.max ZirCAD, the material must not be used to fabricate restorations.

## Composition

The IPS e.max ZirCAD blocks and the corresponding processing accessories consist of the following main components:

- **IPS e.max ZirCAD blocks**  
Components: ZrO<sub>2</sub>  
Additional contents: HfO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub> and other oxides
- **IPS e.max ZirCAD Colouring Liquid**  
Components: Water, ethanol, colouring salts, additives
- **IPS Contrast Spray Labside**  
Components: Pigment suspension in ethanol, propellant: propane-butane mixture
- **IPS Natural Die Material**  
Components: Polyester urethane dimethacrylate, paraffin oil, SiO<sub>2</sub> and copolymer
- **IPS Natural Die Material Separator**  
Components: Wax dissolved in hexane

## Scientific Data

Further scientific data (e.g. strength, wear, biocompatibility) are contained in the "Scientific Documentation IPS e.max ZirCAD". The Documentation also provides a set of studies that describe the clinical performance of IPS e.max ZirCAD.

This Scientific Documentation can be obtained from Ivoclar Vivadent.

For further information about all-ceramics in general, please refer to the Ivoclar Vivadent Report No. 16 and Report No. 17 for IPS e.max in particular.



## Block concept - IPS e.max ZirCAD for inLab

IPS e.max ZirCAD is available in nine block sizes and three shades (MO 0, MO 1, MO 2). This provides utmost flexibility during block selection with regard to both the shade and the blocks size.

The following IPS e.max ZirCAD blocks are available:



Block designation Dimensions in mm (width x length x height)		MO 0	MO 1	MO 2	Can be used in...	
					inLab®	inLab® MCXL
<b>IPS e.max ZirCAD for inLab C 13</b> 13.2 x 13.2 x 14.0						
<b>IPS e.max ZirCAD for inLab C 15</b> 14.5 x 15.5 x 18.5						
<b>IPS e.max ZirCAD for inLab C 15 L</b> 15.4 x 19.0 x 20.0						
<b>IPS e.max ZirCAD for inLab B 40</b> 14.2 x 15.5 x 40.0						
<b>IPS e.max ZirCAD for inLab B 40L</b> 15.4 x 19.0 x 39.0						
<b>IPS e.max ZirCAD for inLab B 55</b> 15.5 x 19.0 x 55.0						
<b>IPS e.max ZirCAD for inLab B 65</b> 22.0 x 25.0 x 65.0						
<b>IPS e.max ZirCAD for inLab B 65 L-17</b> 17.0 x 40.0 x 65.0						
<b>IPS e.max ZirCAD for inLab B 85 L-22</b> 22.0 x 40.0 x 85.0						

The entire IPS e.max delivery program can be found at [www.ivoclarvivadent.com!](http://www.ivoclarvivadent.com!)

## CAD/CAM Partners

IPS e.max ZirCAD can be processed with either the inLab® System (Sirona) or the inLab® MCXL. For questions regarding the different systems, please contact the respective cooperation partners.



For further information, please contact

**Sirona Dental Systems GmbH**

Fabrikstrasse 31  
64625 Bensheim

Germany

E-mail: [contact@sirona.de](mailto:contact@sirona.de)

[www.sirona.com](http://www.sirona.com)



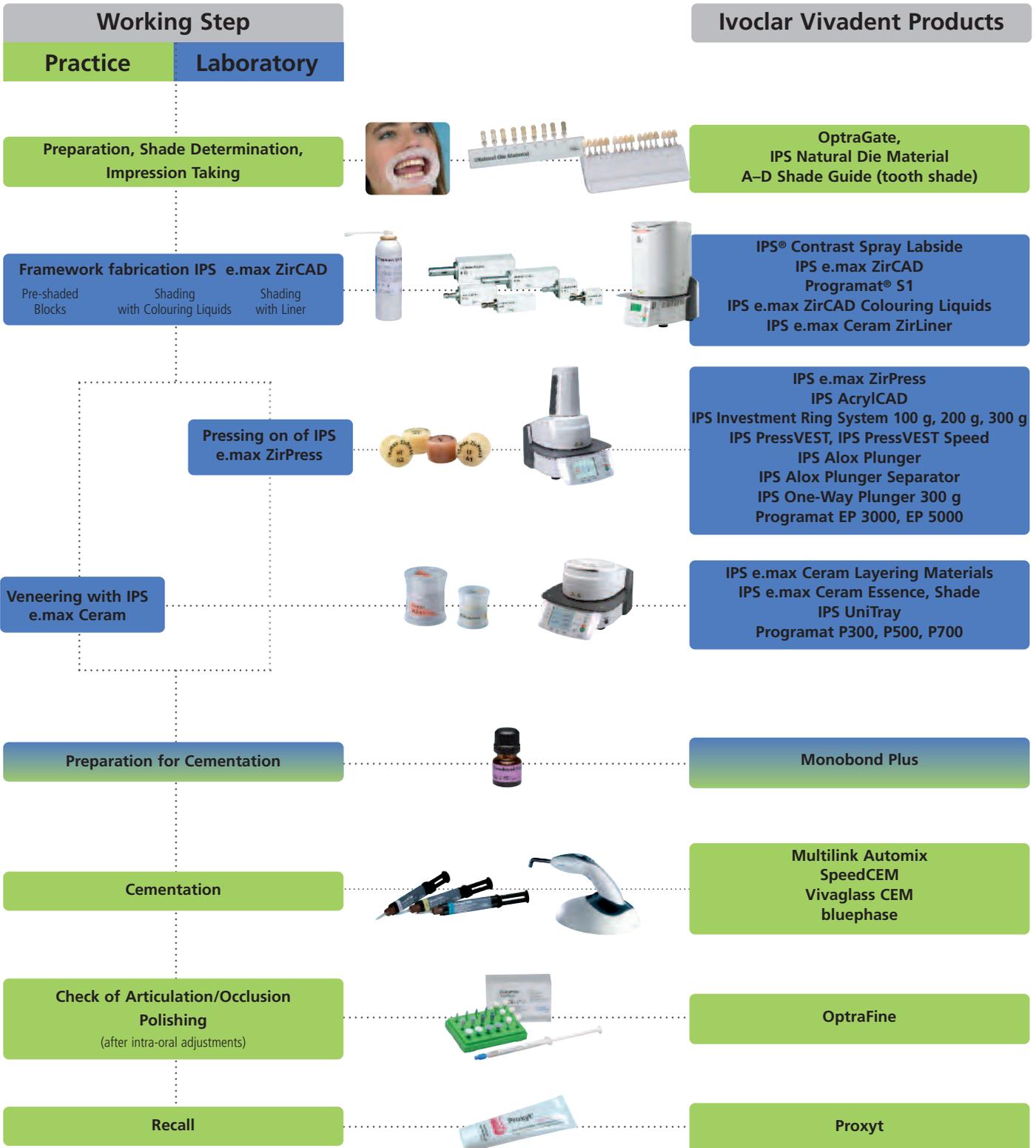
inLab® is a registered trademark of Sirona Dental Systems GmbH

# IPS e.max® ZirCAD

## Clinical Steps, Model Preparation, CAD/CAM Process



Clinical Steps, Model Preparation, CAD/CAM Process



The range of available products may vary from country to country.

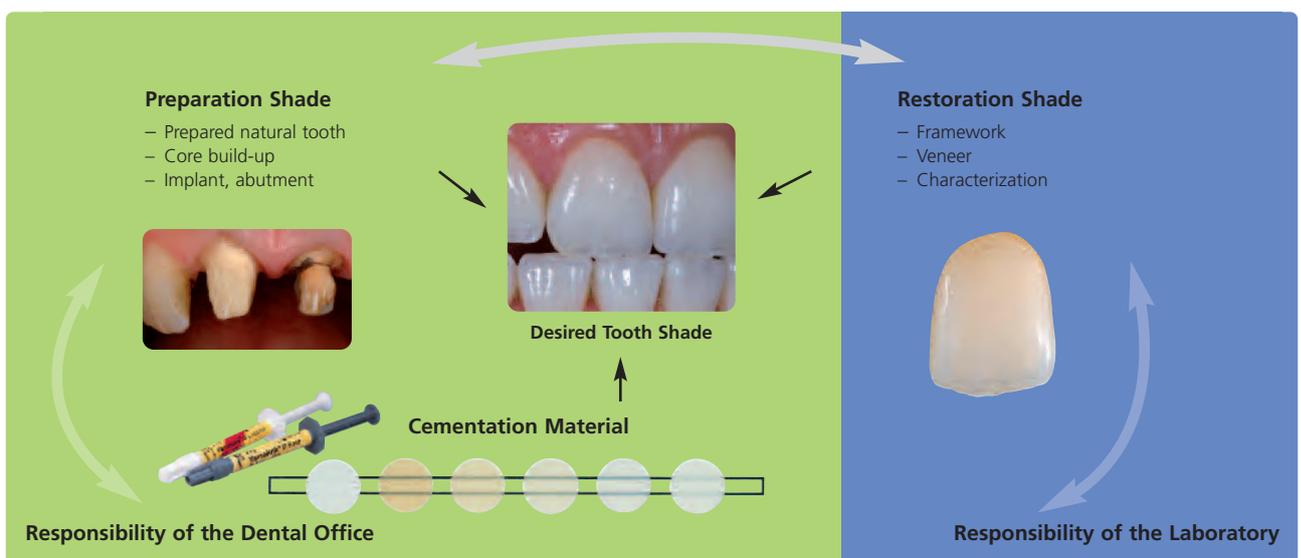
## Shade Determination – Tooth Shade, Shade of the Prepared Tooth

Optimum integration in the oral cavity of the patient is the prerequisite for a true-to-nature all-ceramic restoration. To achieve this, the following guidelines and notes must be observed by both the dentist and the laboratory.

The overall esthetic result of an all-ceramic restoration is influenced by the following factors:

- **Shade of the preparation** (natural preparation, core build-up, abutment, implant)
- **Shade of the restoration** (framework shade, veneer, characterization)
- **Shade of the cementation material**

The optical effect of the preparation shade must not be underestimated during the fabrication of highly esthetic restorations. Especially with severely discoloured preparations or non-tooth-shaded build-ups, this is of utmost importance. Only if the dentist determines the shade of the preparation and its subsequent transmission to the laboratory may the desired esthetics be achieved in a targeted fashion.



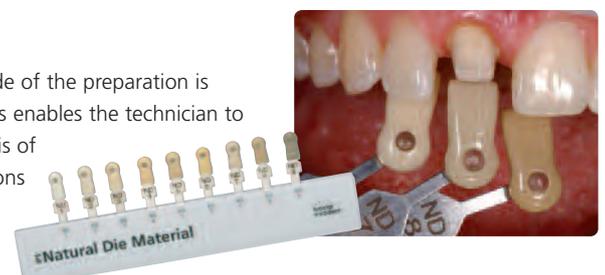
### Shade determination of the natural tooth

After tooth cleaning, the tooth shade of the non-prepared tooth and/or the adjacent teeth is determined with the help of a shade guide. Individual characteristics have to be considered when determining the tooth shade. If a crown preparation is planned, for example, the cervical shade should also be determined. In order to achieve the best possible true-to-nature results, shade determination should be carried out at daylight. Furthermore, the patient should not wear clothes of intensive colours and/or lipstick.



### Die shade selection

In order to facilitate the reproduction of the desired tooth shade, the shade of the preparation is determined with the help of the IPS Natural Die Material shade guide. This enables the technician to fabricate a model die similar to the preparation of the patient, on the basis of which the correct shade and brightness values of the all-ceramic restorations may be selected.

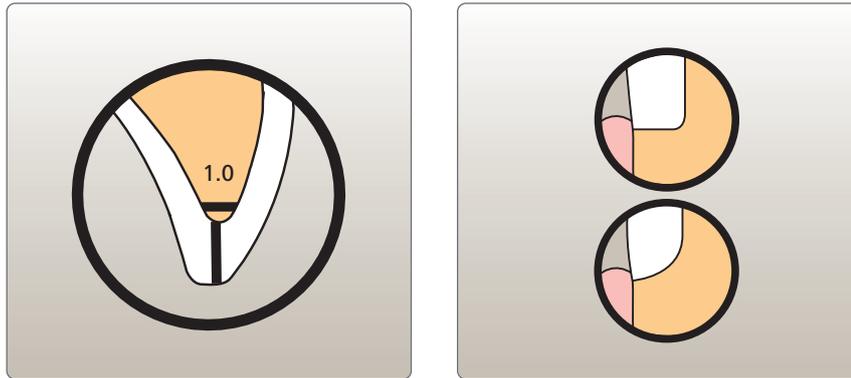




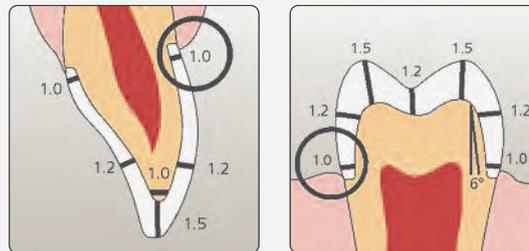
## Preparation Guidelines

### Basic preparation guidelines for all-ceramic restorations:

- no angles or sharp edges
- shoulder preparation with rounded inner edges and/or chamfer preparation
- the indicated dimensions reflect the minimum thickness for IPS e.max ZirCAD restorations
- the radius of the preparation edges, particularly for anterior teeth, should be at least 1 mm (milling tool geometry) in order to permit optimum milling during CAD/CAM processing.

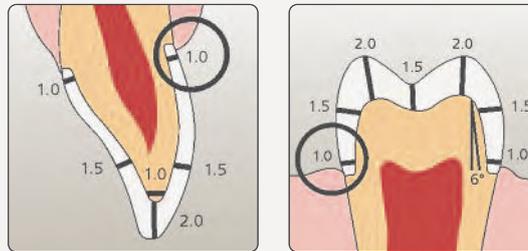


### Single Crowns to 3-Unit Bridges



- Evenly reduce the anatomical shape and observe the stipulated minimum thickness. Prepare a circular shoulder with rounded inner edges or a chamfer of a width of at least 1.0 mm.
- Reduce the incisal crown third – incisal and/or occlusal – by approx. 1.5 mm.
- For anterior crowns, the reduction in the labial and/or palatal/lingual area is at least 1.2 mm. The incisal edge of the preparation should be at least 1.0 mm (milling tool geometry) in order to permit optimum milling of the incisal area during CAD/CAM processing.
- For posterior crowns, the reduction in the buccal and/or palatal/lingual area is at least 1.2 mm.
- For conventional and/or self-adhesive cementation, the preparation must demonstrate retentive surfaces.

## Multi-Unit Bridges



- Evenly reduce the anatomical shape and observe the stipulated minimum thickness. Prepare a circular shoulder with rounded inner edges or a chamfer of a width of at least 1.0 mm.
- reduce the incisal crown third – incisal and/or occlusal – by approx. 2.0 mm.
- For anterior crowns, the reduction in the labial and/or palatal/lingual area is at least 1.5 mm. The incisal edge of the preparation should be at least 1.0 mm (milling tool geometry) in order to permit optimum milling of the incisal area during CAD/CAM processing.
- For posterior crowns, the reduction in the buccal and/or palatal/lingual area is at least 1.5 mm.
- For conventional and/or self-adhesive cementation, the preparation must demonstrate retentive surfaces.

## Model and Tooth Preparation

Fabricate a working model with removable segments as usual. The directions of the manufacturers of the different CAD/CAM systems regarding the plaster to be used must be observed.

Important for die preparation:

- Check the radius of the incisal/occlusal edge on the prepared die (maxilla and mandible).
- The prepared incisal edge should be at least as thick as the diameter of the bur used in the cavity during the CAD/CAM process.
- If the incisal edge of the prepared die is thinner than the diameter of the bur, the incisal edge has to be blocked out accordingly.
- Also observe the information provided by the manufacturer of the CAD/CAM system regarding the die geometry.



A model with detachable segments is used as the basis.

## Layer thicknesses

The restoration design is key to the success of durable all-ceramic restorations. The more attention given to the design, the better the final results and the clinical success will turn out to be. The following basic guidelines have to be observed:

- The IPS e.max ZirCAD framework material is the high-strength component of your restoration and must always be given a design that supports the overall shape of the restoration and the cusps.
- In large preparations and for veneered or partially veneered restorations, the excess available space must be compensated by the corresponding dimensions of the high-strength IPS e.max ZirCAD component and not by the pressed-on or layered-on materials. The design of the restoration generated by the software has to be individually adjusted, if necessary, in accordance with the clinical situation using the design tools.
- If possible, the connector design should be extended in the vertical direction, rather than in the horizontal direction.

The following minimum thicknesses have to be observed for the framework design with IPS e.max ZirCAD (sintered):

**Please note:** The minimum dimensions of the IPS e.max ZirCAD framework before sintering must be larger by the shrinkage factor.

### Minimum dimensions IPS e.max ZirCAD (sintered)

Anterior Region		Crowns	Splinted crowns	3-Unit Bridges	4-12-unit bridges with 2 pontics	Cantilever bridges with 1 pontic
Minimum framework dimensions	circular	0.5 mm	0.5 mm	0.5 mm	0.7 mm	0.7 mm
	incisal	0.7 mm	0.7 mm	0.7 mm	1.0 mm	1.0 mm
Connector dimensions		–	7 mm <sup>2</sup>	7 mm <sup>2</sup>	9 mm <sup>2</sup>	12 mm <sup>2</sup>
Design type		Supporting the tooth shape and/or gingiva (incisal, occlusal and/or basal)				

Posterior Region		Crowns	Splinted crowns	3-Unit Bridges Inlay-retained bridges	4-12-unit bridges with 2 pontics	Cantilever bridges with 1 pontic
Minimum framework dimensions	circular	0.5 mm	0.5 mm	0.5 mm	0.7 mm	0.7 mm
	occlusal	0.7 mm	0.7 mm	0.7 mm	1.0 mm	1.0 mm
Connector dimensions		–	9 mm <sup>2</sup>	9 mm <sup>2</sup>	12 mm <sup>2</sup>	12 mm <sup>2</sup>
Design type		Supporting the tooth shape and/or gingiva (incisal, occlusal and/or basal)				

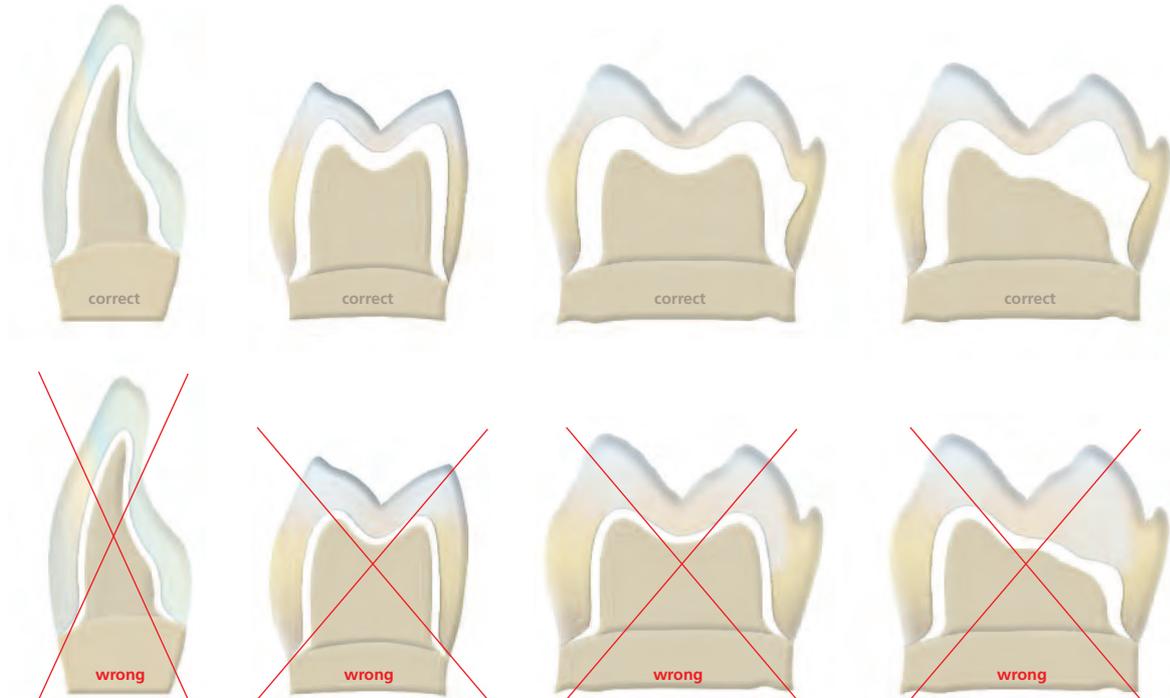
The framework must be designed in such a way that it supports the tooth shape and the gingiva shape and so that upon the subsequent veneering with IPS e.max Ceram or pressing over with IPS e.max ZirPress the following maximum dimensions are not exceeded:

Layer thickness veneer <b>IPS e.max® Ceram</b>	max. 2.5 mm
Layer thickness pressed-on restoration <b>IPS e.max® ZirPress</b>	max. 2.5 mm

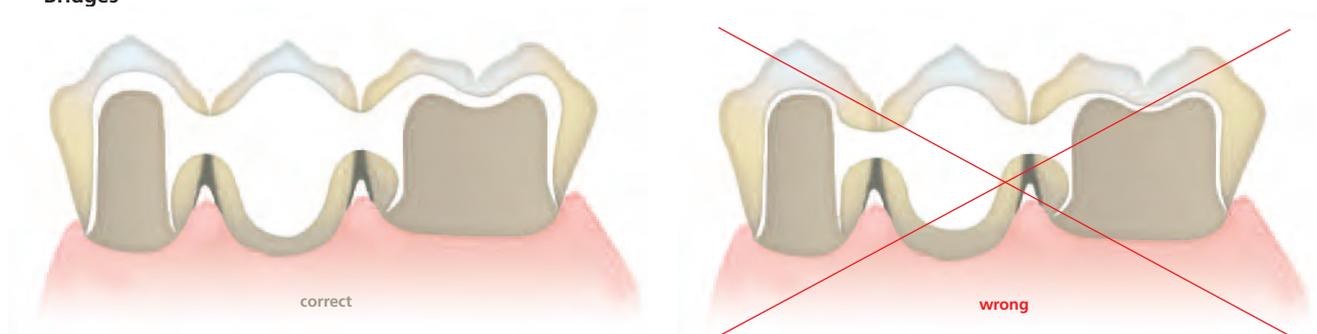
**Failure to observe the stipulated framework design criteria and minimum thicknesses may result in clinical failures, such as cracks, delamination and fracture of the restoration.**

## Framework Design Criteria

### Anterior and Posterior Crowns

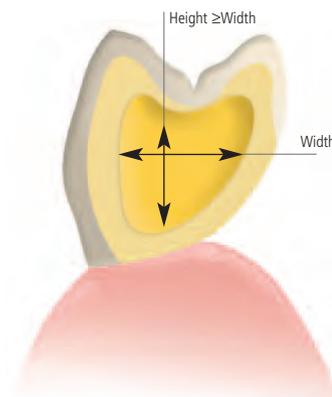


### Bridges



Always observe the relation between width and height as well as the suitable dimensions when designing the connectors.

Basically, the following applies:  $\text{Height} \geq \text{Width}$





## CAD/CAM processing

Since the IPS e.max ZirCAD frameworks shrink by approximately 20-25% during sintering, the shrinkage factor of the respective batch, which is included in the bar code on the material block, must be read into the software. If the scanner is unable to read the barcode, it has to be entered and confirmed manually by means of the keyboard. The shrinkage factor then ensures that the milled IPS e.max CAD restorations demonstrate optimum accuracy of fit after sintering. Do not exceed the maximum amount of abrasive agent. Before milling IPS e.max ZirCAD blocks, the milling fluid should be changed to avoid cross-contamination (e.g. milling dust). Contamination may result in discolouration of the frameworks during sintering. Before the IPS e.max ZirCAD blocks B 65 L-17 and B 85 L-22 are processed, the water in the container and the milling tools must be exchanged. The fabrication steps are described in the directions for use and user manuals of the different CAD/CAM systems. Please observe the corresponding instructions of the manufacturer.

For the fabrication of multi-unit bridge frameworks, as well as the use of the stack milling mode, please observe the notes on page 26.



Sirona – inLab® and inLab® MCXL



Milled IPS e.max ZirCAD framework

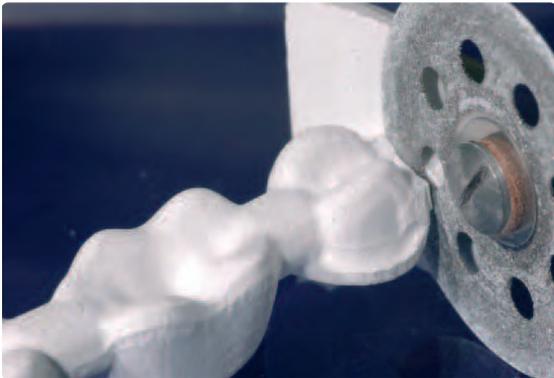
## Crowns and Bridges – Framework Fabrication

### Finishing

It is of critical importance to use the correct grinding instruments for finishing and adjusting IPS e.max ZirCAD. If unsuitable grinding instruments are used, chipping of the edges and local overheating may occur (please observe the Ivoclar Vivadent Flow Chart "Recommended grinding tools for PS e.max zirconium oxide").

Observe the following procedure for finishing IPS e.max ZirCAD frameworks:

- Non-sintered zirconium oxide frameworks are susceptible to damage and fractures. This fact has to be kept in mind during the entire working procedure.
- Rinse the milled framework under slightly running water to remove all milling residue.
- All adjustments by grinding should always be carried out while the framework is still in its non-sintered stage, if possible. Do not use water/oil cooling or contact media (e.g. occlusion spray).
- Only use suitable grinding instruments, low speed and light pressure to prevent delamination and chipping at the margins in particular.
- Do not use fine rubber polishers for finishing frameworks to be shaded with an infiltration solution, since this will seal the surface and result in uneven shading.
- Carefully separate the milled framework from the holder using a fine diamond disk and smooth out the attachment area with suitable grinding instruments.
- Rough tungsten carbide burs and/or grinding instruments with large diameters are only suitable to a certain extent, since they may cause vibrations during finishing, which may result in chipping. Therefore, only small tungsten carbide burs and/or grinding instruments with small diameters should be used.
- Do not 'post-separate' the bridge framework with separating disks. This may result in undesired predetermined breaking points, which will subsequently compromise the stability of the all-ceramic restoration.
- Make sure that the minimum thicknesses are maintained even after the minor adjustments.
- In the non-sintered state, the marginal areas must be given special attention. Too thinly ground margins are unsuitable for sintering, since the marginal area is rounded out during sintering and will become too short.
- After finishing, clean the framework with compressed air to remove grinding dust. If the framework is still moist, additionally clean it under running water.
- Make sure that all grinding residue (e.g. grinding dust) is removed. Adhering grinding dust may get fused to the framework during sintering and result in inaccuracy of fit.
- The framework **must not** be cleaned with ultrasound in a water bath or with a steam jet.
- Do **not** blast the framework with  $Al_2O_3$  or glass polishing beads.



Carefully separate the milled framework from its holder using a separating disk.



Finish the non-sintered framework with suitable grinding instruments.



Round out sharp angles and edges created during the milling procedure.



Smooth out adjusted areas keeping the minimum thickness in mind.



Comparison of a milled and a finished IPS e.max ZirCAD framework.



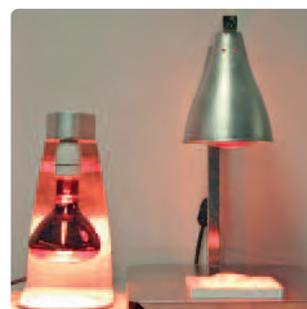
Finished IPS e.max ZirCAD framework ready for sintering.

## Drying

In order to prevent damage to the framework during sintering, the IPS e.max ZirCAD framework must be completely dry. Moist frameworks must not be sintered.

Please observe the following notes for drying:

- The framework must be free of dust and grinding residue.
- The framework can be dried either in a drying cabinet or under an infrared lamp.
- Place the frameworks on the occlusal surface for drying.
- Please note: With infrared lamps (250W), the distance (5–20 cm) to the object influences the temperature exerted on the object.
- The drying time depends on the temperature. For drying the frameworks, a temperature of 140 °C (284 °F) must not be exceeded. With lower temperatures, the drying times are prolonged.
- The drying time also varies with the size of the framework. The following table contains the corresponding drying times.



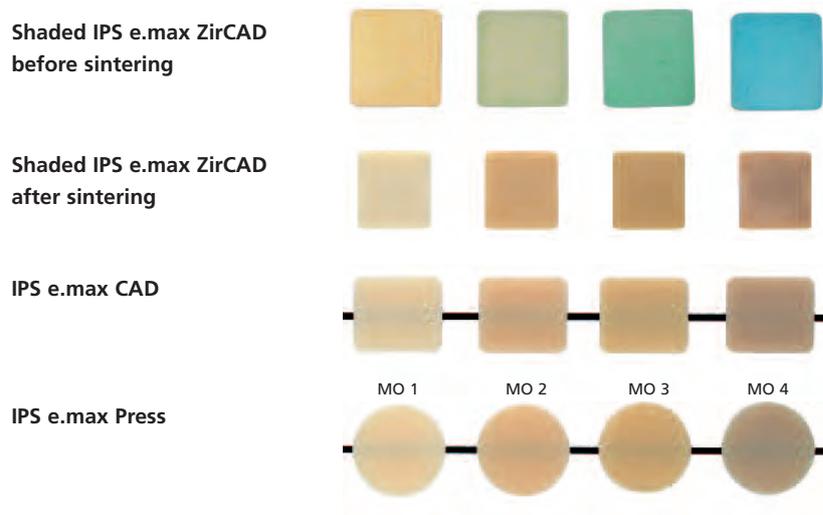
### Drying times for IPS e.max ZirCAD depending on the restoration size and temperature

	Temperature ~70 °C (158 °F)	Temperature ~140 °C (284 °F)
Single-tooth frameworks	≥15 min	5-10 min
3-4-unit bridge frameworks	≥40 min	≥25 min
5- and more-unit bridge frameworks	≥50 min	≥25 min

## Shading (optional)

For shading the IPS e.max ZirCAD frameworks, four Colouring Liquids (CL1-CL4) are available\*. With the shading, the framework shade is adjusted to the IPS e.max shade concept. The classification according to the tooth shade is listed in the combination table (page 43).

**Comparison of shaded IPS e.max ZirCAD before and after sintering and IPS e.max CAD MO and IPS e.max Press MO.**



\*The range of available products may vary from country to country.

### Note:

- **The framework to be shaded must be completely dry.**
- If residual moisture is present in the framework, the colouring solution cannot be absorbed in these areas, which may result in uneven shading.
- If the Colouring Liquid shows white streaks during shading, the framework was not adequately cleaned after the milling process.



Finished IPS e.max ZirCAD framework



Thoroughly rinse milling dust from the framework under running water.  
Use a brush, if required.

The following procedure must be observed when shading the frameworks:

- Select the required IPS e.max ZirCAD Colouring Liquid (observe the combination tables) and fill the working cup up to approximately 2 cm.
- For multi-unit bridges, an IPS e.max ZirCAD Colouring jar XL is available.
- Place the IPS e.max ZirCAD framework in the sieve insert of the working cup.
- In order to avoid air entrapments, position the occlusal surface towards the bottom.
- Carefully dip the framework in the sieve insert into the Colouring Liquid.
- Slightly swivel the cup to remove small air bubbles from the surface of the framework.
- An immersion time of the framework in the Colouring Liquid of 2 min. ensures a penetration of a wall thickness of  $\geq 0.7$  mm.
- The immersion time should not exceed 2 min. Deviations in the infiltration time may lead to shade variations.

- After the resting time in the Colouring Liquid, remove the framework from the sieve insert using the plastic tweezers.
- Briefly rinse off residues of the Colouring Liquid with water. If several restorations are shaded at the same time, they can be rinsed together in the sieve insert.
- Blow dry the framework with oil-free compressed air.
- The framework must be dried prior to the sintering procedure. Moist frameworks must not be sintered, since this will impair the sintering of the zirconium oxide.
- **The framework is dried in the same way as before shading (see page 15).**
- The Colouring Liquid may remain in the closed working cup until the next application. It is not necessary to pour the liquid into another container.
- If the Colouring Liquid shows severe contamination (precipitation), it should be replaced.

**Caution when working with the IPS e.max ZirCAD Colouring Liquids!**  
 The solution is irritating to eyes and skin. If the material should accidentally come into contact with the skin or eyes, immediately wash with copious amounts of water and seek medical attention if needed. Use suitable protective clothing, gloves and goggles when working. Contamination on skin, clothes or laboratory equipment might be impossible to remove.



For multi-unit bridges, an IPS e.max ZirCAD Colouring jar XL is available.



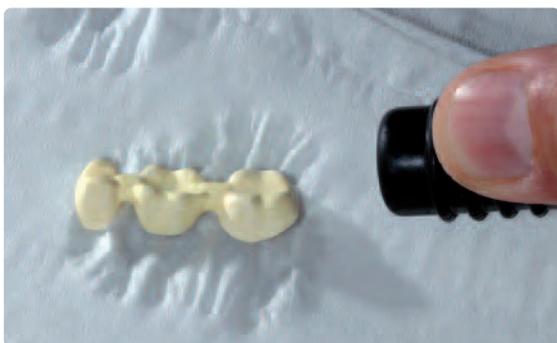
Fill the working cup with approximately 2 cm with Colouring Liquid and place the dry IPS e.max ZirCAD framework with the occlusal surface facing down in the sieve insert.



Dip the framework into the Colouring Liquid for 2 minutes to ensure a penetration of a wall thickness of  $\geq 0.7$  mm.



Remove the framework from the sieve insert using tweezers and briefly rinse it under running water.



Blow dry the framework with oil-free compressed air.



Comparison: unshaded and shaded IPS e.max ZirCAD framework prior to sintering.

## Sintering in the Programat® S1

We recommend using the Programat S1 high-temperature furnace to sinter the IPS e.max ZirCAD frameworks. The furnace programs are optimally adjusted to the IPS e.max ZirCAD material and its sinter shrinkage and thus help you achieve the best possible results.

**Allow a sufficiently long drying time** (see table on page 15) depending on the size before sintering the frameworks. Please note that frameworks that are sintered while still being moist may be damaged due to the high heating rate.



Please observe the following points for sintering in the Programat S1. Position the dried frameworks on the sinter table supplied with the S1.

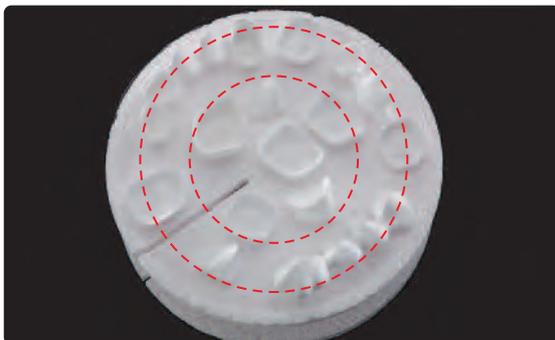
- As a basic principle, **do not use ZrO<sub>2</sub> sintering beads in the Programat S1.**
- The sinter tray can be entirely filled with frameworks. Make sure that the frameworks do not touch each other.
- Simultaneous sintering of single-tooth and bridge frameworks as well as frameworks with a sinter support structure is possible.
- Observe the program selection.
- Provide even support for the frameworks.
- Bridge frameworks should not exclusively be supported by the abutment crowns on either side. Preferably place the frame on the pontics. The abutment crowns do not absolutely have to come into contact with the sinter tray.
- Arrange the frameworks in concentric circles on the sinter tray, particularly bridge frameworks.
- **Important:** Do not place any frameworks over the separation in the sinter tray.
- Place the loaded sinter tray in its intended position in the centre of the S1 sintering chamber using the sinter tray fork.



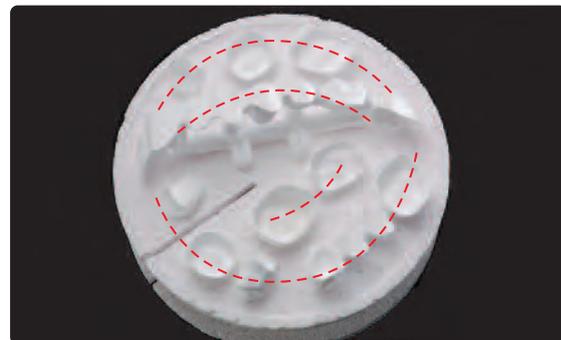
Sinter tray



Sinter tray fork

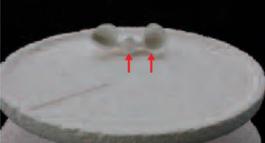
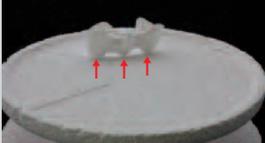
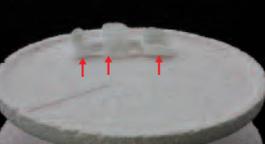
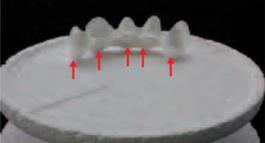
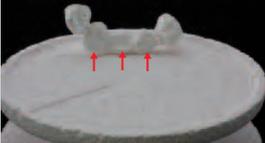
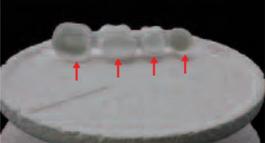
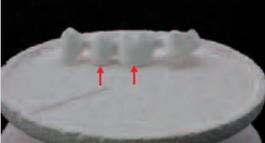
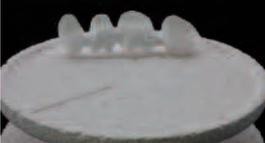
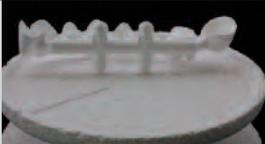


Arrange the frameworks in concentric circles on the sinter tray. This ensures even temperature distribution within the framework during heating and cooling.



Frameworks with or without sinter support structure may be sintered simultaneously. Observe the program selection. The frameworks must not touch each other. Do not place any frameworks over the separation in the sinter tray.

Observe the following points when positioning the frameworks on the sinter tray:

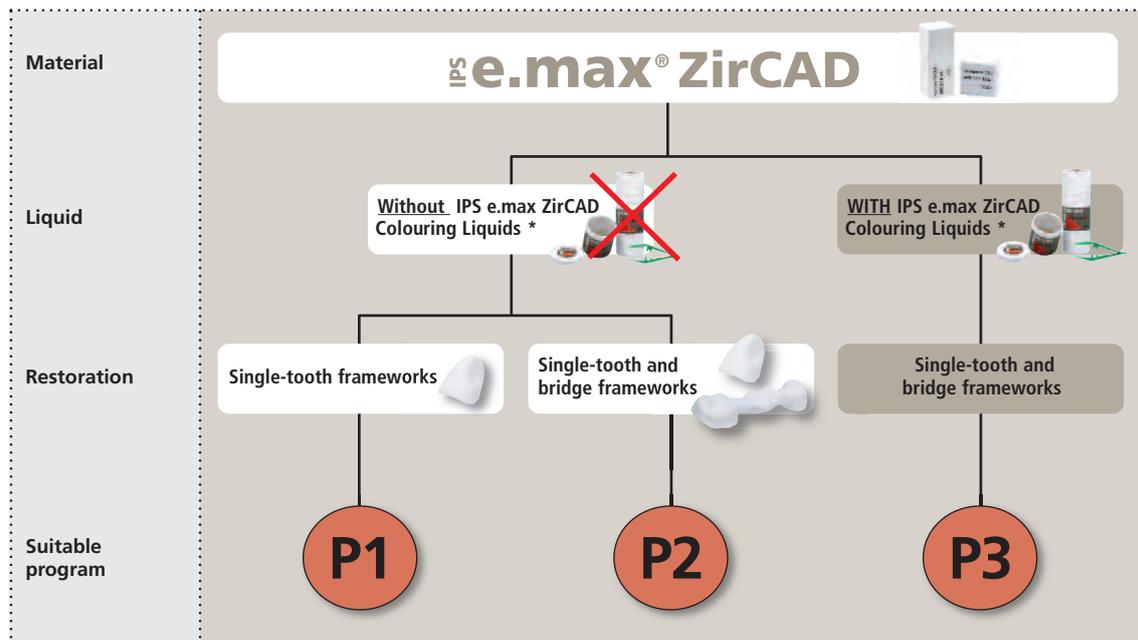
	correct	OK	wrong
<b>Single-tooth frameworks anterior region</b>	 <p>Place the frameworks on their labial surface</p>	 <p>Place the frameworks on their lingual surface</p>	 <p>Do not place the frameworks on their marginal edges</p>
<b>Single-tooth frameworks posterior region</b>	 <p>Place the frameworks on their occlusal surface</p>		 <p>Do not place the frameworks on their marginal edges</p>
<b>3-unit anterior frameworks</b>	 <p>Place the frameworks on their labial surface and provide support to the pontic. If the framework "tilts", make sure that the crown margins do not touch the sinter tray.</p>	 <p>Position on the incisal surfaces. The pontic must also rest on the sinter tray.</p>	 <p>Framework placed incorrectly. Do not place the frameworks on the marginal edges of the abutment crowns.</p>
<b>3-unit posterior frameworks</b>	 <p>Place the frameworks on the occlusal surface depending on the curvature. Make sure the pontic is supported.</p>	 <p>Place the frameworks on the buccal or lingual surfaces depending on the curvature. Abutment crowns do not have to come into contact with the sinter tray. The pontic must rest on the sinter tray.</p>	 <p>Incorrect positioning. Do not place the framework on its crown margins. If the crown margins were in the air, the framework could also be placed on its basal side.</p>
<b>&gt;4-unit anterior frameworks</b>	 <p>Place the frameworks on their incisal surfaces. Make sure the pontics are supported.</p>	 <p>Depending on the curvature, the framework can be placed on its labial surfaces. All the pontics must touch the sinter tray. Abutment crowns do not have to come into contact with the sinter tray.</p>	 <p>Framework placed incorrectly. The pontics are not supported and the abutment crown margins rest on the sinter tray.</p>
<b>&gt;4-unit posterior frameworks</b>	 <p>Depending on the curvature, the framework can be placed on its buccal surfaces. All the pontics must come into contact with the sinter tray. Abutment crowns do not have to touch the sinter tray.</p>	 <p>Incorrect positioning. Do not place the framework on its crown margins. If the crown margins could also be placed on its basal side.</p>	 <p>Framework placed incorrectly. The pontics are not supported.</p>
<b>Frameworks with sinter support structure</b>	 <p>Place the framework on the sinter tray with the sinter support structures resting on the tray. The marginal edges of the abutment crowns on either side must not come into contact with the sinter tray.</p>	 <p>The framework can also be placed on the sinter support structure / incisal or occlusal surfaces of the pontics. For this purpose, the sinter support structure must face the centre of the sinter tray.</p>	 <p>Framework placed incorrectly. Do not place the framework on its crown margins.</p>

↑ Points where the framework touches the sinter tray.

Select the sintering program in accordance with the materials used (with or without IPS e.max ZirCAD Colouring Liquids) and the respective indication (single-tooth frameworks or bridge frameworks) and start the process. Please refer to the Programat S1 Operating Instructions for details regarding the various sintering programs.

- Remove the sinter tray from the furnace after the sintering process using the sinter tray fork. Always allow the frameworks to cool to room temperature before proceeding.

Program	Name	Description	Duration
1	IPS e.max ZirCAD crown	Program for the <b>quick</b> sintering of IPS e.max ZirCAD single-tooth frameworks <b>without IPS e.max ZirCAD Colouring Liquids</b>	90 min
2	IPS e.max ZirCAD bridge	Program for the <b>quick</b> sintering of IPS e.max single-tooth and bridge frameworks <b>without IPS e.max ZirCAD Colouring Liquids</b>	2 h 45 min
3	IPS e.max ZirCAD Colouring Liquid	Program for the <b>quick</b> sintering of IPS e.max single-tooth and bridge frameworks <b>with IPS e.max ZirCAD Colouring Liquids</b>	3 h 30 min



\* The range of available products may vary in different regions.

**Note regarding the use of IPS e.max ZirCAD Colouring Liquids**

- Frameworks shaded with IPS e.max ZirCAD Colouring Liquids have to be adequately pre-dried using a corresponding pre-drying furnace. Air drying is not sufficient and may result in cracks developing in the object during sintering.

**Notes on the maintenance of the Programat S1**

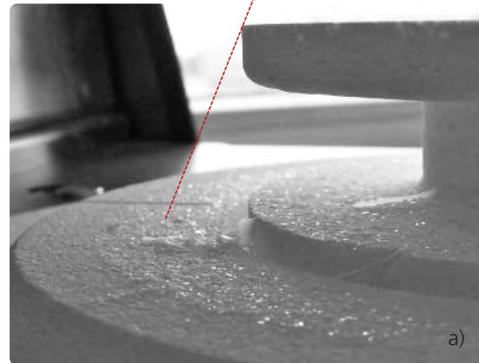
**– Visual inspection of the sintering chamber**

**Visually inspect the sintering chamber before every sintering procedure.**

No foreign objects or dirt particles must be in the sintering chamber during sintering. Contamination may result, among other things, from flaking of the oxide / protective layer of the heating element surface. Impurity caused by such contamination may jeopardize the optical appearance of the sintered object.

Impurities resulting from a flaking oxide layer can be divided into two categories:

Type of contamination	Appearance
Glass particles	Glassy, transparent particles are well visible on the insulation of the furnace base and/or the sinter tray rest.
Fine glass dust	Fine glass dust has accumulated on the insulation of the furnace base and/or the cooling tray. This type of contamination is more difficult to recognize, but may also lead to the discolouration of the objects.



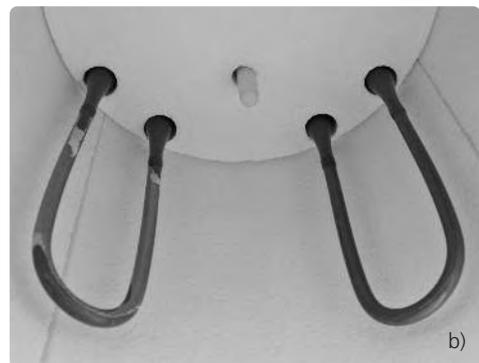
If glass particles or fine glass dust are detected during the visual inspection, the sintering chamber must be cleaned (see Cleaning of the sintering chamber and Programat S1 Operating Instructions).

**– Visual inspection of the sintering chamber**

Use only the cleaning brush supplied with the Programat S1 for cleaning purposes. Do not use compressed air under any circumstances. After cleaning, Program P1 must be run with no load (IPS e.max ZirCAD crown). Running the cleaning program is recommended in case of severe contamination.

**– Cleaning of the heating elements**

With the cleaning program, the flaked oxide / protective layer on the heating elements is restored. If an even protective layer on the heating elements is not noticeable after the cleaning program, it is possible that running the cleaning program several times in a row is required. Do not sinter any ZrO<sub>2</sub> frameworks when running the cleaning program. Clean the sintering chamber before running the cleaning program.



A large area of the protective layer of the left heating element has flaked off. The right heating element is in good, stable condition with an intact oxide / protective layer. The cleaning program has to be repeated until the surface is again free of contamination and has a glassy appearance.

## Sintering with Sintramat

Once the framework is completely dry, the sintering procedure can be carried out. During the sintering process, the approximately 20% enlarged, milled IPS e.max ZirCAD framework will shrink to its final size. As a result, good accuracy of fit is achieved.



For the sintering process, the following points should be observed:

- For the sintering of IPS e.max ZirCAD frameworks in the Sintramat, exclusively use the firing sagger and sintering beads intended for this purpose.
- Fill the firing sagger with max. 100 g of ZrO<sub>2</sub> sintering beads and place the framework in the centre of the firing sagger.
- Place anterior crown and bridge frameworks on the sintering beads with the incisal surfaces facing the beads.
- Place posterior crown and bridge frameworks on the sintering beads with the occlusal surfaces facing the beads.
- Lightly press the frameworks into the bead bed. Do not push them in too deeply or the beads may get fused to the IPS e.max ZirCAD frameworks during sintering (e.g. in the interdental area to the pontic)! Make sure that the entire length of the restoration is adequately supported.
- Do **not** use any beads for multi-unit bridges with sinter support structure
- Place the loaded firing sagger in the centre of the firing chamber (room temperature) of the Sintramat. The positioning pins will guide the firing sagger into the ideal position.
- For a larger number of frameworks, the "drawer" principle is applied, by stacking the firing saggars on top of each other. A maximum of 3 firing saggars may be stacked in the Sintramat.
- Close the furnace door once the firing sagger has been placed in the furnace. Pressing the P1 key starts the program and the furnace door is locked. The sintering program runs automatically and takes approximately 8 hours including cooling.
- The sintering temperature is 1500 °C / 2732 °F.
- The Sintramat can only be opened once the temperature has dropped below 97 °C / 206 °F. Please note that there is still a burn hazard at 97 °C / 206 °F. Wear the corresponding protective clothing.
- Remove the firing sagger from the furnace after the sintering process. Always allow the frameworks to cool to room temperature before proceeding.
- Always keep the sintering accessories clean and free of dust so that no contamination may be sintered to the framework.



Firing sagger filled with 100 g ZrO<sub>2</sub> beads



Make sure the framework is adequately supported.



Align the firing sagger with the positioning pins.



Press P1. The sintering program starts automatically and the furnace door is locked.



After completion of the sintering process, allow the firing sagger to cool to room temperature and remove it from the Sintramat.



Comparison of a non-sintered and sintered IPS e.max ZirCAD framework.

**Note:**

- Carefully remove any sintering beads adhering to the framework. After the first few sintering procedures, the beads still strongly adhere to each other after firing. However, they are easily separated manually in the firing sagger. After approximately 3–4 sintering procedures, the adherence is reduced.
- If the heating elements are corroded, run the cleaning program with an empty firing sagger several times by pressing “Clean” until the heating elements are free from any contamination. Do not cover the ventilation tube and ensure adequate ventilation of the sinter furnace during the cleaning program.
- If the heating elements cannot be regenerated, they must be replaced.
- Corrosion of the heating elements is mainly caused by not adequately pre-drying zirconium oxide frameworks.
- The firing saggings with ZrO<sub>2</sub> beads are exclusively intended for the sintering of dental restorations.
- Many large-volume ceramic objects or overloaded firing saggings may damage the sagger.
- If the “drawer” principle with 2 or 3 firing saggings is applied, the individual saggings must be adequately supported. Load the sintering furnace carefully to avoid damage to the heating elements.



Contaminated, severely corroded heating element

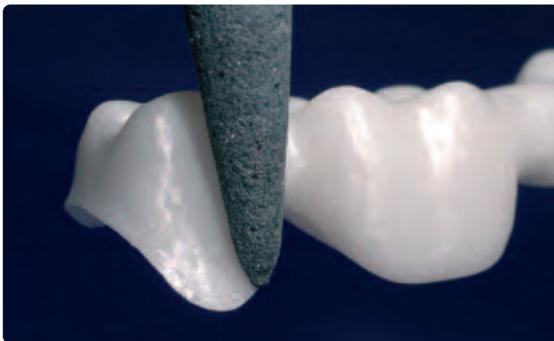


Corroded heating element (left). Repeat the cleaning program several times until the surface of the heating elements is free from contamination and appears glassy (right).

## Framework Finishing After Sintering

Once the IPS e.max ZirCAD restoration has cooled to room temperature, proceed with the following steps:

- Carefully remove adhering ZrO<sub>2</sub> beads using a suitable instrument.
- Finishing of sintered IPS ZirCAD frameworks should be kept to a minimum (fine adjustment of the margins).
- For selecting the grinding instruments, please observe the recommendations for grinding instruments!
- Finishing is carried out at low pressure, since too much pressure may result in marginal chipping and local phase transition. The instructions of the manufacturer of the grinding instruments must be observed.
- Place the IPS e.max ZirCAD framework on the model, check fit and make slight adjustments, if necessary.
- Do not "post-separate" the bridge framework with separating disks after sintering. This may result in undesired predetermined breaking points, which will subsequently compromise the stability of the all-ceramic restoration.
- Check marginal areas and slightly finish, if necessary.
- Make sure that the minimum thicknesses are maintained even after the minor adjustments.
- Before veneering, clean the framework with running water or the steam jet and dry.
- Do **not** blast the framework with Al<sub>2</sub>O<sub>3</sub> or glass polishing beads, since this may damage the surface and strongly jeopardize the bond with the layering ceramic.



Use the grinding instruments specifically developed for ZrO<sub>2</sub> to carry out the required adjustments.



Completely sintered and finished IPS e.max ZirCAD framework.

## Regeneration Firing (optional)

Note: adjustments of sintered IPS ZirCAD frameworks should be kept to a minimum.

A Regeneration firing is only recommended after:

- Large-scale adjustment of the IPS e.max ZirCAD framework (e.g. reduction of cusps and overall thickness)
- Use of grinding instruments not listed in the IPS e.max grinding tool recommendations.
- Grinding with diamond grinding tools (graining >100 µm).

**Please note:**

Fractures or cracks in the IPS e.max ZirCAD framework caused by rough finishing, e.g. blasting with high pressure, cannot be "healed" by a Regeneration firing.

A Regeneration firing should be conducted in order to reverse changes in the sintered ZrO<sub>2</sub> due to extensive or aggressive finishing (see above). Please observe the following procedure for conducting the Regeneration firing:

- Clean and dry the framework with a steam jet.
- Position the framework on metal pins on a honey-combed tray, or direct on the sinter tray if Programat S1 is used.
- Conduct the Regeneration firing in a ceramic furnace (e.g. Programat P700 or the sinter furnace Programat S1) using the respective parameters.
- As an option, a regular sinter firing in the Sintramat (Program P1) can be conducted again.



**Firing parameters for the IPS e.max ZirCAD Regeneration firing in the ceramic furnace or sinter furnace Programat S1**

Furnace	B °C/°F	S min	t <sub>1</sub> °C/°F	T <sub>1</sub> °C/°F	H <sub>1</sub> min	L °C/°F	t <sub>2</sub> °C/°F
P300 P500 P700 EP 3000 EP 5000	403 757	0:18	65 117	1050 1922	15:00	750 1382	25 45
P80 P100 P200 EP 600	403 757	0:18	65 117	1050 1922	15:00	750 1382	—
PX1	403 757	0:30	65 117	1050 1922	15:00	750 1382 12 min	—
S1	Regeneration firing program 7						

- Do **not** adjust the framework by grinding after the Regeneration firing.
- Do **not** blast the framework with Al<sub>2</sub>O<sub>3</sub> or glass polishing beads before veneering, since this may cause lasting damage to the surface.
- Before veneering, clean IPS e.max ZirCAD framework under running water or with a steam jet.



Clean the IPS e.max ZirCAD framework with steam before veneering.



Do **not** blast the framework with Al<sub>2</sub>O<sub>3</sub> or glass polishing beads.

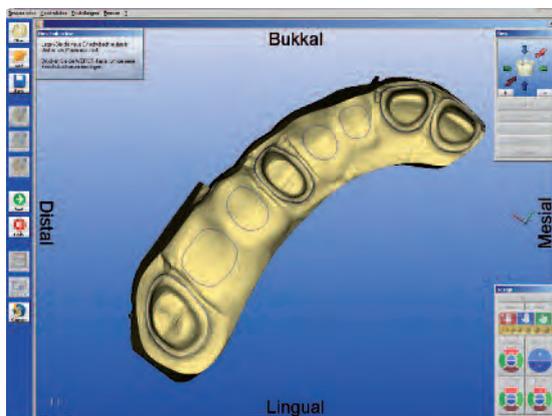
## Notes on the Fabrication of multi-unit Bridge Frameworks

For multi-unit bridge frameworks (>5 bridge units), the following supplementary/different working steps have to be observed.

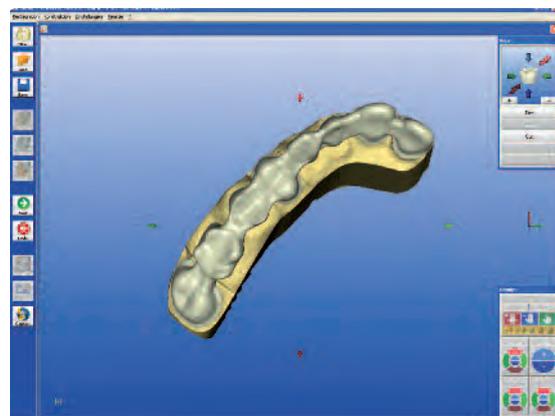
### CAD construction

After scanning of the model, the bridge framework is constructed on the PC. For that purpose, the following points have to be observed in addition to the procedure for smaller bridge frameworks:

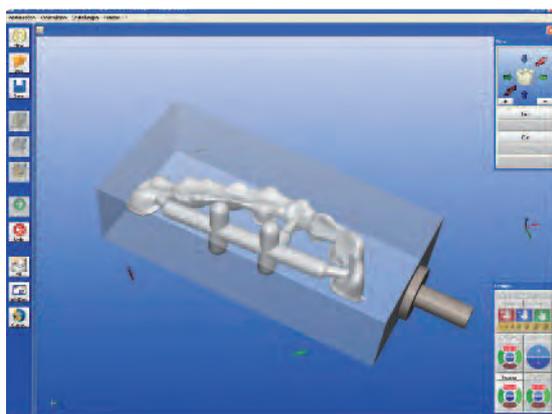
- Define the insertion axis in such a way that the framework can be inserted on all the preparations involved. Furthermore, it is important that no undercuts are created so that no difficulties occur during milling.
- Define the preparation margins as well as the rests for the bridge units.
- Check the automatically generated framework suggestion and adjust it to the clinical situation using the design tools.
- Observe the minimum thicknesses for the framework as well as the maximum layer thicknesses for the veneering material and/or the material to be pressed on.
- View the sintering support in the milling preview.
- With the block representation in the milling preview, the "position" of the framework within the block can be visualized.
- If the framework protrudes from the block on one side (red marking), the framework can be moved in the occlusal/ cervical direction using the positioning tools.
- Position the framework within the block in such a way that it is entirely within the block. If part of the sinter structure does not fit into the block, the framework may still be milled.
- If the framework is not within the block even after moving, the direction of insertion must be changed.
- **Place the attachment point at the mesial abutment crown for multi-unit restorations.**



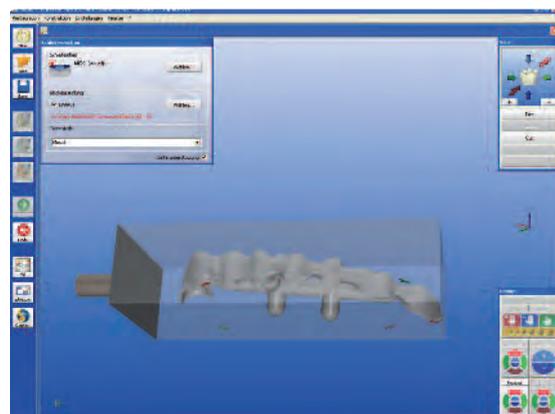
Define the insertion axis, preparation margins as well as the rests for the bridge units.



Adjust the framework suggestion to the clinical situation using the design tools. Observe the minimum thicknesses and connector dimensions.



Milling preview with the sinter support structure shown, attachment point at the mesial abutment.



If parts of the framework are not located within the block in the block representation (red markings), move the framework using the positioning tools.

**CAM Process**

The IPS e.max ZirCAD B 65 L-17 and IPS e.max ZirCAD B 85 L-22 blocks are processed using inLab MC XL (from software version: inLab 3D V 3.60).

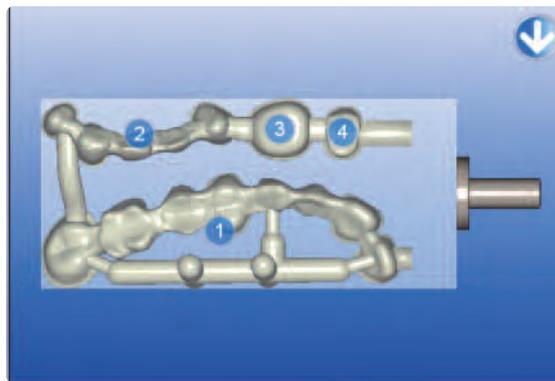
Users have the option to either mill multi-unit frameworks or to process several frameworks in one milling procedure by means of stack milling. After the selection of various frameworks (milling data) they are automatically placed within the "block" and the milling procedure can be started.

For further information regarding the procedures, please refer to the directions for use and user manuals of the different CAD/CAM systems. Please observe the corresponding instructions of the manufacturer.

**Example:**

**Milling preview in the stack milling application**

1. 8-unit framework with sinter support structure
2. 5-unit framework
3. Single-tooth framework
4. Single-tooth framework



**Note:**

Use the standard parameters for the connector dimensions and the restoration distance. Switch on the horizontal stack frame.

**Important:**

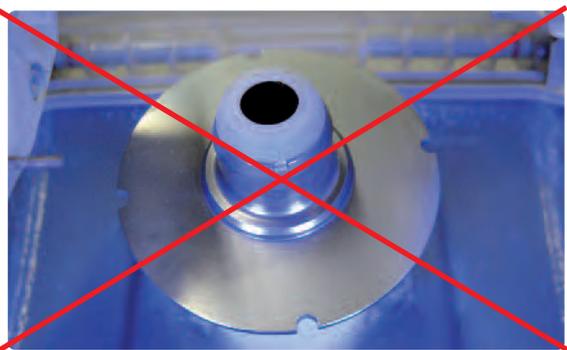
For the processing of IPS e.max ZirCAD B 65 L-17 and IPS e.max ZirCAD B 85 L-22 in inLab MC XL the one-piece milling tools, as well as the chuck with screw-type lock **must be used**. Before the milling process, the milling tools have to be replaced and the water changed.



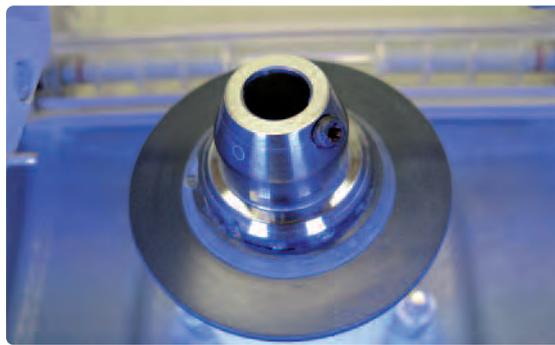
Milling tools clamped in the chuck must **not** be used.



Use the one-piece milling tools to process the large blocks.



The automatic chuck must **not** be used.

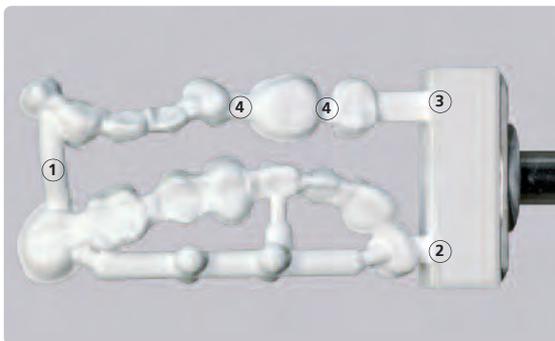


Use the manual block chuck to process the large blocks.

### Finishing and Preparation for Sintering

Please observe the following procedure after milling:

- Note: the finishing guidelines on page 14 apply.
- When stack milling, the frameworks must be separated from each other very carefully in order to prevent fractures.
- Please observe the following sequence when separating the individual frameworks:
  1. Connection at the outermost end
  2. Attachment point to the block
  3. Attachment point to the block
  4. Individual units from each other
- Single-tooth frameworks as well as smaller bridge frameworks are carefully separated from each other with a diamond separating disk.
- Do not separate multi-unit bridge frameworks from the sinter support structure. It is only removed after the sintering procedure.
- Smooth out attachment points and finish the framework with suitable grinding instruments.
- Please refer to pages 15 for all the working steps regarding drying and preparing for sintering.



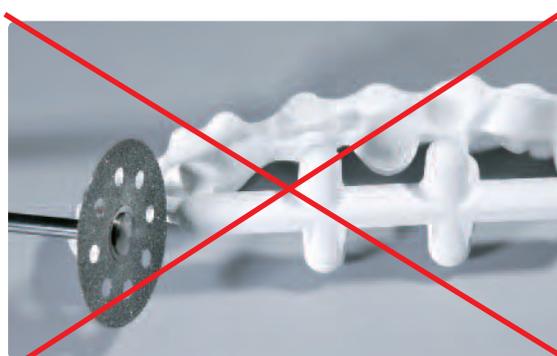
Please observe the following sequence when separating the individual frameworks.



① Separate the connection at the outermost end.



② Separate the attachment point to the block



Do not separate the sinter support structure. It is only removed after the sintering procedure.



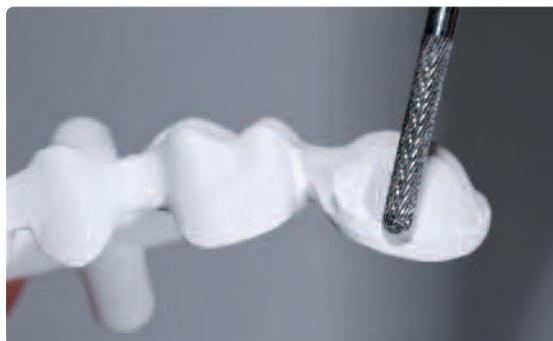
③ Separate the attachment point to the block



④ Separate individual units from each other.



Frameworks after separation



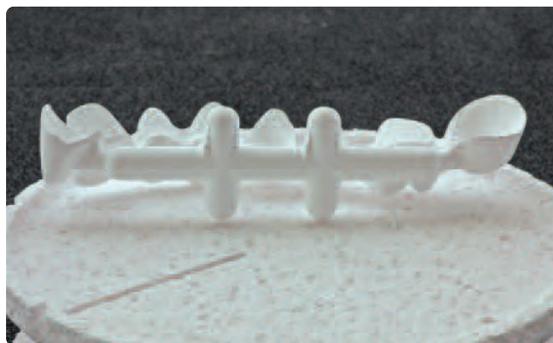
Smooth out attachment points on the framework with suitable grinding instruments, e.g. fine tungsten carbide burs.

### Sintering

For sintering, please observe the notes on page 18–22. Observe the following procedure for multi-unit frameworks:

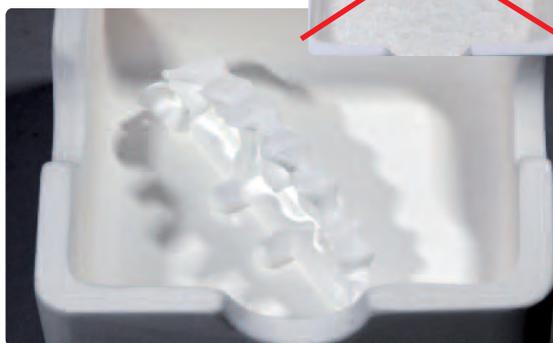
#### Sintering in the Programat S1

- The frameworks are placed on the sinter support structure on the sinter tray upright or on their side.
- Sintering is conducted using Program 2.



#### Sintering in the Sintramat

- For sintering in the Sintramat, an empty firing sagger **without ZrO<sub>2</sub> beads** is used.
- Place the framework in the firing sagger either on the sinter support structure or with the occlusal surface facing down.
- As for all the frameworks, sinter in the Sintramat using Program P1.



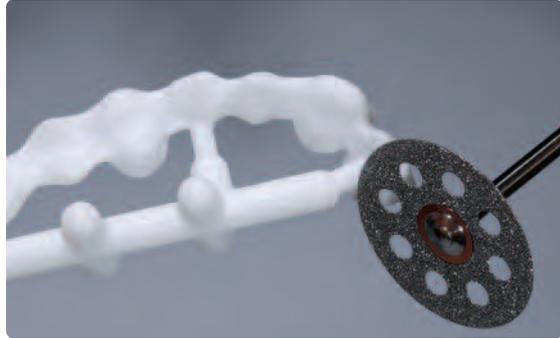
### Framework Finishing After Sintering

Once the restoration has cooled to room temperature, proceed as follows:

- Separate the sinter structure using a diamond separating disk under constant water cooling of the grinding area. Overheating of the ceramic must be avoided. Low speed and light pressure is recommended.
- See page 24 for further notes on finishing the framework.



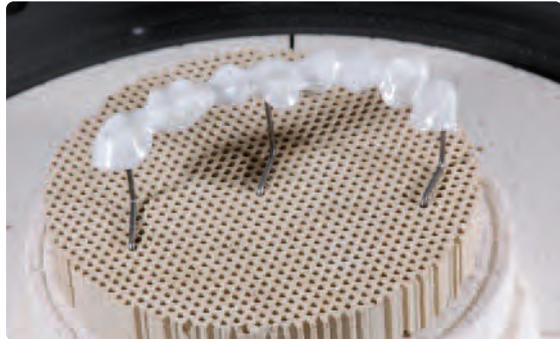
After completion of the sintering process, allow the restoration to cool to room temperature.



Separate the sinter structure using a diamond separating disk under constant water cooling of the grinding area.



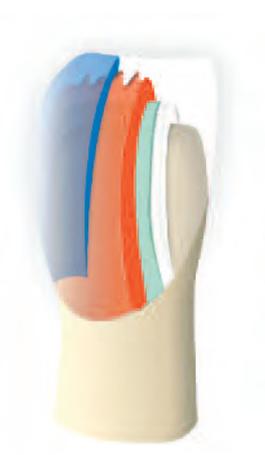
Finish the framework with suitable grinding instruments.



Conduct a final Regeneration firing for multi-unit bridges.

# IPS e.max<sup>®</sup> ZirCAD – Veneering with IPS e.max Ceram

The following paragraphs will explain the most important steps for veneering IPS e.max ZirCAD with IPS e.max Ceram. For further information on the nano-fluorapatite layering ceramic and its processing, please refer to the IPS e.max Ceram Instructions for Use.



## Firing process for zirconium oxide-supported restorations

In order to obtain optimum firing results for IPS e.max Ceram, the following points have to be observed:

- In order to ensure an even thickness of the veneer, the zirconium oxide framework must be designed in such a way that it supports the cusps. Depending on the clinical situation, this may entail different wall thicknesses and dimensions of the framework.
- Since  $ZrO_2$  is a poor heat conductor compared to other framework materials, a low **temperature increase rate  $t_r$**  is required. This ensures even heat distribution in the bonding area between the framework and the veneer, as well as the outer surfaces of the restoration even with different framework thicknesses. In this way, an optimum bond, as well as even sintering of the layering materials are achieved.
- During cooling of the restorations after firing, stress occurs as a result of the different cooling speed at the outside and within the material. With **long-term cooling L** for the “final firing cycle” this stress can be reduced and the risk of delamination minimized, particularly in  $ZrO_2$ -supported restorations.

## Notes on cooling after completion of the firing program

In order to ensure “smooth” cooling of the restoration after firing, please observe the following notes:

- Wait for the acoustic signal or optical indication of the furnace at the end of the firing cycle before the firing tray with the fired objects is removed.
- Do not touch the hot objects with metal tongs.
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not blast or quench the objects.

**ZirLiner firing**

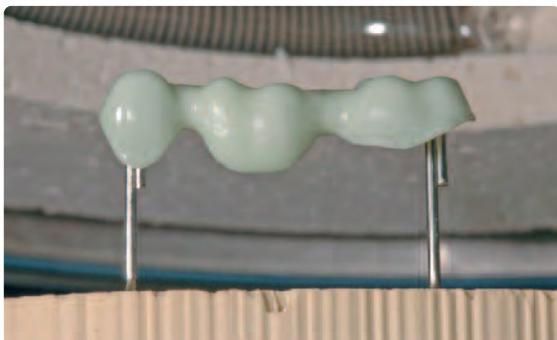
The restoration must be free of dirt and grease before the application of ZirLiner. Any contamination after cleaning must be prevented. Please observe the following procedure:

**For non-shaded zirconium oxide frameworks, use the IPS e.max Ceram ZirLiner 1–4. For shaded zirconium oxide frameworks, use IPS e.max Ceram ZirLiner clear.**

- IPS e.max Ceram ZirLiner must always be applied prior to the layering procedure in order to achieve a sound bond as well as an in-depth shade effect and fluorescence.
- Direct layering procedures on IPS e.max ZirCAD frameworks without using IPS e.max Ceram ZirLiner results in a poor bond and may lead to delamination.
- Mix the IPS e.max Ceram ZirLiner with the corresponding liquid to a creamy consistency.
- If a different consistency is desired, IPS e.max Ceram Build-Up Liquid (allround or soft) as well as the IPS e.max Ceram Glaze and Stain Liquids (allround or longlife) may be used. The liquids may also be mixed with each other at any mixing ratio.
- Apply ZirLiner on the entire framework, paying special attention to the margins. If required, the restoration may be vibrated until an even, greenish colour effect is achieved. If the colour appears too pale, the layer is too thin.
- For more intensively shaded areas, four IPS e.max Ceram Intensive ZirLiners (yellow, orange, brown, incisal) are available.
- After that, the applied ZirLiner is briefly dried and fired.
- After firing, the IPS e.max Ceram ZirLiner should exhibit a layer thickness of approx. 0.1 mm



Mix the corresponding IPS e.max Ceram ZirLiner with IPS e.max Ceram ZirLiner Build-Up Liquid to a creamy consistency.



Make sure that an even, greenish colour-effect is achieved.



Colour difference between IPS e.max ZirCAD framework with and without ZirLiner.

**Firing parameters for the ZirLiner firing — note the temperature control**

IPS e.max Ceram ZirLiner on IPS e.max ZirCAD	B °C/°F	S min.	t ↑ °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing	403/757	4:00	40/72	960/1760	1:00	450/842	959/1758	0



## Optional

### 1<sup>st</sup> Margin firing

After the ZirLiner firing, the reduced framework may be provided with a ceramic shoulder. The following steps must be observed:

- Before the ceramic shoulder is applied, cover the model die with IPS Margin Sealer and allow it to dry. After that, isolate the shoulder areas using IPS Ceramic Separating Liquid.
- Place the framework on the die and make sure it is correctly positioned.
- Subsequently, mix IPS e.max Ceram Margin in the desired shade with the corresponding Margin Build-Up Liquid (allround or carving) and apply in drop-shaped increments.
- For more intensively shaded areas, 4 Intensive Margin materials (yellow, yellow-green, orange and orange-pink) are available.
- Contour the Margin material as desired and dry.
- Carefully remove the framework with the applied and dried shoulder material from the die, place it on a firing tray, and fire.



### 2<sup>nd</sup> Margin Firing

After the firing, the shoulder may have to be slightly adjusted by grinding. Observe the following procedure for the 2<sup>nd</sup> Margin firing:

- Isolate the die again with IPS Ceramic Separating Liquid.
- Complete the areas affected by shrinkage and any missing area using the same Margin material that was used for the 1<sup>st</sup> firing.
- Depending on the size of the gap, the shoulder material may be carefully applied into the space.
- Carefully remove the framework with the completed and dried shoulder material from the die, place it on a firing tray, and fire.
- After the 2<sup>nd</sup> firing, the shoulder may require minor adjustment to achieve very good accuracy of fit.



Place the framework on the isolated die and apply IPS e.max Ceram Margin in drop-shaped increments



Completed ceramic shoulder after firing

### Firing parameters for the 1<sup>st</sup> and 2<sup>nd</sup> Margin firing — note the temperature control

IPS e.max Ceram on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>↑</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
1 <sup>st</sup> and 2 <sup>nd</sup> Margin firing	403/757	4:00	40/72	800/1472	1:00	450/842	799/1471	0

**Important:** IPS e.max Ceram Margin materials are only suitable for the application on IPS e.max ZirCAD and other zirconium oxide frameworks and must not be used in conjunction with glass-ceramic materials.

**Wash firing (Foundation)**

The low heat conductivity of zirconium oxide requires a Wash firing. The Wash firing ensures controlled sintering of the ceramic onto the framework surface and enables a homogeneous bond to the fired ZirLiner. In order to achieve this:

- Mix the required IPS e.max Ceram Dentin or Deep Dentin material with the IPS e.max Ceram Build-Up Liquids allround or soft. If a different consistency of the ceramic is desired, the liquids may also be mixed with each other at any mixing ratio.
- Apply the wash in a thin coat on the entire fired ZirLiner.
- Position the restoration on the firing tray and fire it according to the stipulated firing parameters.



Apply the Wash using Dentin and/or Deep Dentin materials and fire using the stipulated firing parameters.

**Firing parameters Wash firing (Foundation) – note the temperature control**

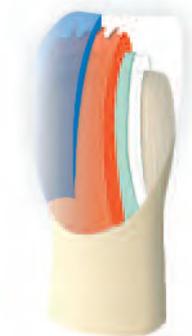


IPS e.max Ceram on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>↕</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
Wash firing (foundation)	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0

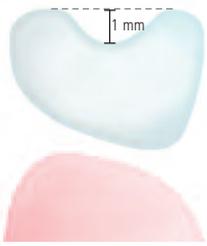
### 1<sup>st</sup> Dentin and Incisal firing

In order to achieve highly esthetic restorations, please observe the following procedure:

- Before layering, apply IPS Model Sealer and allow it to dry. After that, isolate the corresponding areas using IPS Ceramic Separating Liquid.
- Place the framework on the model and make sure it is correctly positioned.
- Mix the required IPS e.max Ceram layering materials with the Build-Up Liquids allround or soft. If a different consistency of the ceramic is desired, the liquids may also be mixed with each other at any mixing ratio.
- Underlay the pontic area with Deep Dentin in the next lighter shade and make sure that the framework seats fully. After that, layer these areas using Deep Dentin and Dentin materials.
- The low heat conductivity of zirconium oxide may present challenges in achieving properly fired veneering ceramic in the case of restorations with an abnormally deep occlusal fossa or bulky molar pontics. There are two procedures to achieve the desired firing result, nonetheless:
  - Conduct an intermediate or support firing with Deep Dentin or Dentin over the entire surface, in order to distribute the shrinkage on 2 firing cycles. What is more, this facilitates the positioning of the Impulse materials during the second firing.
  - Occlusal separation of the central fissure with a scalpel beyond the marginal ridge before the first firing. In this way, the ceramic can be sintered to the framework surface in a controlled fashion. During the subsequent 2<sup>nd</sup> Dentin and Incisal firing, the central fissure and the occlusal surface are supplemented.



Standard occlusal surface



Deep occlusal surface



Massive bridge pontic

- Subsequently, conduct the layering procedure according to the layering diagram. Observe the necessary layer thickness.
- For individual characterization, use e.g. Occlusal Dentin.
- Carefully remove the restoration from the model and supplement the contact points.
- Do not apply excessive blotting and prevent the restoration from drying out.
- Before firing, all the interdental areas must be separated down to the framework using a scalpel.
- Position the restoration on the firing tray and fire it according to the stipulated firing parameters.



Isolate the model and place the ZrCAD framework in the correct position.



Contour the tooth shape with Dentin materials.



Complete the layering procedure with Incisal and Transpa materials. Completely separate the interdental area prior to firing.

### Firing parameters for the 1<sup>st</sup> Dentin and Incisal firing – note the temperature control

IPS e.max Ceram on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>r</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
1 <sup>st</sup> Dentin/Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0

### 2<sup>nd</sup> Dentin and Incisal firing (Corrective firing)

Compensate for the shrinkage and complete the missing areas.

### Firing parameters for the 2<sup>nd</sup> Dentin and Incisal firing – note the temperature control

IPS e.max Ceram on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>r</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
2 <sup>nd</sup> Dentin/Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0

Depending on the furnace type, the firing temperature can be reduced by 5 °C to max. 10 °C (9 °F to max. 18 °F) for the 2<sup>nd</sup> Dentin and Incisal firing.

### Stain and Glaze firing

Stain firing is conducted with IPS e.max Ceram Essence and Shades, while glaze powder, paste or spray is used for Glaze firing.

### Firing parameters for the Stain and Glaze firing – note the slow cooling!

IPS e.max Ceram on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>r</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
Stain firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Glaze firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842

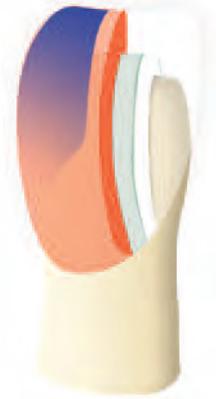


Completely veneered and individually characterized IPS e.max ZirCAD restoration.

# IPS e.max® ZirCAD – Pressing over with IPS e.max ZirPress (Staining Technique)



The following paragraphs will explain the most important steps for pressing over IPS e.max ZirCAD with IPS e.max ZirPress. For further information on the fluorapatite press ceramic and its processing techniques, please refer to the IPS e.max ZirPress Instructions for Use.



### ZirLiner firing

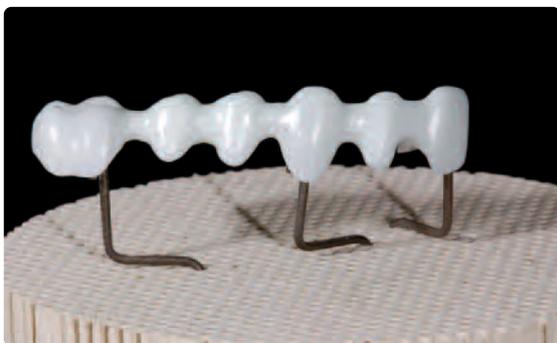
The restoration must be free of dirt and grease before the application of ZirLiner. Any contamination after cleaning must be prevented. Please observe the following procedure:

**For non-shaded zirconium oxide frameworks, use the IPS e.max Ceram ZirLiner 1–4. For shaded zirconium oxide frameworks, use IPS e.max Ceram ZirLiner clear.**

- IPS e.max Ceram ZirLiner must always be applied prior to pressing in order to achieve a sound bond, as well as an in-depth shade effect and fluorescence.
- Direct press-on procedures on IPS e.max ZirCAD frameworks without using IPS e.max Ceram ZirLiner result in a poor bond and may lead to delamination.
- Mix the IPS e.max Ceram ZirLiner with the corresponding liquid to a creamy consistency.
- If a different consistency is desired, IPS e.max Ceram Build-Up Liquid (allround or soft) as well as the IPS e.max Ceram Glaze and Stain Liquids (allround or longlife) may be used. The liquids may also be mixed with each other at any mixing ratio.
- Apply ZirLiner on the entire framework, paying special attention to the margins. If required, the restoration may be vibrated until an even, greenish colour effect is achieved. If the colour appears too pale, the layer is too thin.
- For more intensively shaded areas, four IPS e.max Ceram Intensive ZirLiners (yellow, orange, brown, incisal) are available.
- After that, the applied ZirLiner is briefly dried and fired.
- After firing, the IPS e.max Ceram ZirLiner should exhibit a layer thickness of approx. 0.1 mm.



Mix the corresponding IPS e.max Ceram ZirLiner with IPS e.max Ceram ZirLiner Build-Up Liquid to a creamy consistency.



Make sure that an even, greenish colour effect is achieved.



The fired ZirLiner shows a homogeneous, silky-mat surface.

### Firing parameters for the ZirLiner firing – note the temperature control

IPS e.max Ceram ZirLiner on IPS e.max ZirCAD	B °C/°F	S min.	t <sup>↑</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing	403/757	4:00	40/72	960/1760	1:00	450/842	959/1758	0





### Contouring

The wax-up is fabricated directly on the fired ZirLiner. For this purpose, use a wax that fires without leaving residue. Observe a wax thickness of at least 0.7 mm, or an incomplete pressing may result.

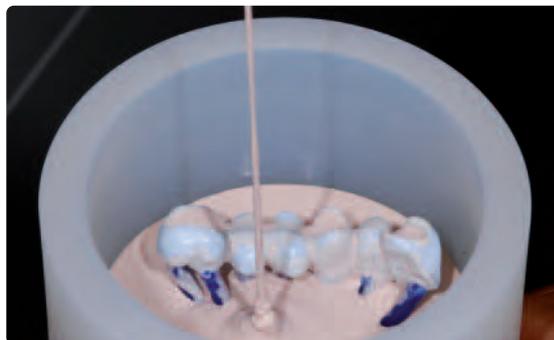


Design a fully anatomical wax-up on the framework. Observe the proper wax thickness.

### Spueing, Investing, Pressing

Always attach the sprues in the direction of flow of the ceramic and at the thickest part of the wax-up so that smooth flow of the viscous ceramic during pressing is enabled. Depending on the number of objects to be invested, either the 100 g, 200 g, or 300 g investment ring base is selected. Bridges must only be pressed in the 200 g or 300 g Investment Ring System. The maximum bridge span width depends on the investment ring size (observe a distance of 10 mm to the silicone ring).

Investing is carried out using either IPS PressVEST (overnight) or IPS PressVEST Speed (during the day).



On the IPS e.max investment ring base, attach sprues in the direction of flow of the ceramic and to the thickest part of the restorations.

The restoration is pressed in the press furnace immediately after completion of the preheating cycle. Subsequently, place the investment ring on the cooling grid and allow it to cool to room temperature. Rough divestment is carried out with polishing beads at 4 bar (60 psi) pressure. As soon the restoration is visible, fine divestment is carried out with polishing beads at 2 bar (30 psi) pressure.



After the preheating cycle, place the **cold** ingots and the **cold** IPS One-Way Plunger 300 g into the **hot** investment ring and conduct the pressing procedure.



Rough divesting with polishing jet medium at 4 bar pressure until the objects become visible. Use 2 bar (30 psi) pressure for fine divesting.

**Stain and Characterization firing**

After finishing the restorations, the Stain and Characterization firing is conducted with IPS e.max Ceram Glaze Shades and Essence.



Finish the restoration using suitable instruments at low speed and little pressure.



Conduct the Stain and Characterization firing using IPS e.max Ceram Shades and Essence.

**Firing parameters for the Stain and Characterization firing — note the slow cooling!**

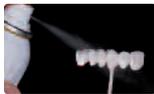


IPS e.max Ceram on IPS e.max ZirPress <i>Staining technique</i>	B °C/°F	S min.	t <sup>↑</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
Stain and Characterization Firing	403/757	6:00	60/108	770/1418	1:00-2:00	450/842	769/1416	450/842

**Additional Stain and Characterization firing cycles can be conducted with the same firing parameters.**

### Glaze firing

Glaze firing is conducted either with IPS e.max Ceram Glaze Powder, Paste or Spray.

 <p>Glaze firing with <b>IPS e.max Ceram Glaze Paste or Powder</b></p> 	 <p>Glaze firing with <b>IPS e.max Ceram Glaze Spray</b></p> 
 <p>Apply the glaze evenly on the surface and fire using the stipulated firing parameters.</p>	 <p>Evenly spray on the IPS e.max Ceram Glaze Spray. If the Glaze Spray accidentally reaches the inner aspects of the restoration, remove it with a dry brush and subsequently conduct the Glaze Firing using the stipulated firing parameters.</p>

### Firing parameters for the Glaze firing — note the slow cooling!

IPS e.max Ceram on IPS e.max ZirPress <i>Staining technique</i>	B °C/°F	S min.	t <sup>r</sup> °C/°F/min.	T °C/°F	H min.	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
Glaze firing	403/757	6:00	60/108	770/1418	1:00-2:00	450/842	769/1416	450/842



**If the gloss is unsatisfactory after the first Glaze firing, further Glaze firing procedures may be conducted using the same firing parameters.**



Completed, glazed IPS e.max ZirPress restoration fabricated in the staining technique.



View of the restoration on a mirror — IPS e.max ZirPress HT pressed to precision.

## Seating and Follow-Up Care

### Possibilities for Cementation

Possibilities for esthetic cementation are decisive for the harmonious shade effect of an all-ceramic restoration. Depending on the indication, IPS e.max restorations can be seated using either adhesive, self-adhesive or conventional cementation.

- For the adhesive cementation of IPS e.max ZirCAD restorations, Multilink® Automix is the ideal composite.
- SpeedCEM® is available for the self-adhesive cementation of IPS e.max ZirCAD.
- We recommend using Vivaglass® CEM, the glass ionomer cement, for the conventional cementation of IPS e.max ZirCAD. \*

\*The range of available products may vary from country to country.

### Short definition of the different cementation methods

#### • Adhesive cementation

With adhesive cementation, the bond is created by static friction, chemical and/or micro-mechanical bond between the luting material and the restoration, as well as between the luting material and the preparation. Given the chemical and/or micromechanical bond, a retentive preparation is not required. Irrespective of the cementation material, special adhesive systems are used on the preparation to generate the micromechanical bond with the dentin and/or enamel. Adhesive cementation results in enhanced "overall strength" of the seated all-ceramic restoration.

#### • Self-Adhesive Cementation

The cementation material features self-etching properties to the tooth, which is why no additional special conditioning of the tooth surface is necessary. Hence, the adhesion of the restoration is partially achieved by a micromechanical and/or chemical bond. In order to achieve sufficient bonding strength values, a retentive preparation is recommended. Self-adhesive cementation does not result in enhanced "overall strength" of the seated all-ceramic restoration.

#### • Conventional Cementation

With conventional cementation, the bond is almost entirely created by static friction between the luting material and the restoration, as well as between the luting material and the preparation. To achieve the necessary static friction, a retentive preparation with a preparation angle of approximately 4-6° is required. Conventional cementation does not result in enhanced "overall strength" of the seated all-ceramic restoration.

### Cementation possibilities for the different indications

		Adhesive Cementation	Self-Adhesive Cementation	Conventional Cementation
IPS e.max ZirPress on IPS e.max ZirCAD	Inlay-retained Bridges	✓	—	—
	Anterior and Posterior Crowns	✓	✓	✓
	Bridges w/w.o. pressed-on shoulder	✓	✓	✓
IPS e.max Ceram on IPS e.max ZirCAD	Anterior and Posterior Crowns	✓	✓	✓
	Bridges w/w.o. pressed-on shoulder	✓	✓	✓



## Preparing for Cementation

Conditioning of the restoration and preparation depends on the cementation method used, as well as the cementation material. The following paragraphs describe the basic working steps to prepare for cementation. Please refer to the Instructions for Use of the corresponding cementation material regarding the detailed processing procedure.

### Conditioning of the restoration

Conditioning of the ceramic surface in preparation for cementation is critical for generating a sound bond between the cementation material and the all-ceramic restoration. For the combination of IPS e.max ZirCAD and IPS e.max ZirPress, conditioning must be carried out according to the respective indication.

The following steps must be observed:

- The surface of zirconium oxide-supported restorations may be cleaned with max. 1 bar (15 psi) pressure before cementation.
- High-strength zirconium oxide ceramics are generally not etched with hydrofluoric acid gel (IPS Ceramic Etching Gel), since no etching pattern is produced. In pressed-over inlay-retained bridges – with contact of the glass-ceramic and the tooth structure – the pressed-on glass-ceramic must be etched with hydrofluoric acid (IPS Ceramic Etching Gel).
- Thoroughly clean the restoration with water and blow dry.
- For adhesive cementation, condition the bonding surface of the restoration using Monobond Plus.

Material	IPS e.max ZirCAD / IPS e.max ZirPress			IPS e.max ZirCAD / IPS e.max Ceram	
	Zirconium oxide / Nano-fluor apatite glass-ceramic			Zirconium oxide / Nano-fluor apatite glass-ceramic	
Indication	Crowns + bridges w./w.o. pressed shoulder		Inlay-retained bridges	Crowns + bridges	
Cementation method	adhesive	self-adhesive / conventional	adhesive	adhesive	selfadhesive / conventional
Blasting	Cleaning with Al <sub>2</sub> O <sub>3</sub> at max. 1 bar (15 psi)		—	Cleaning with Al <sub>2</sub> O <sub>3</sub> at max. 1 bar (15 psi)	
Etching	—		20 sec with IPS® Ceramic Etching Gel	—	
Conditioning/ Silanization	60 sec with Monobond® Plus	—	60 sec with Monobond® Plus	60 sec with Monobond® Plus	—
Cementation system	Multilink® Automix	SpeedCEM Vivaglass® CEM	Multilink® Automix	Multilink® Automix	SpeedCEM Vivaglass® CEM



Please observe the corresponding Instructions for Use.

### Conditioning of the preparation

Thoroughly clean the preparation once the temporary has been removed. Before it is conditioned, the restoration is tried-in and the occlusion and articulation checked. If adjustments are required, the restoration may be polished extraorally in this areas before final incorporation.

Conditioning of the restoration and preparation depends on the cementation method used and is carried out according to the respective Instructions for Use.

### Care notes

Same as natural teeth, high-quality IPS e.max ZirCAD restorations require regular professional care. This is beneficial for both the health of the gingiva and teeth, as well as the overall appearance. The pumice-free Proxyt pink polishing paste is used to care for the surfaces without causing any wear. The low RDA value = 7 (Relative Dentin Abrasion) is a reliable confirmation to use a cleaning paste that is only a little abrasive. Scientific investigations and long-term clinical experience have proved the gentle effect compared to other pastes.



## General Information

### Frequently Asked Questions

#### What is stack milling?

Several frameworks can be milled in one milling procedure from the IPS e.max ZirCAD blocks.

#### Do the IPS e.max ZirCAD frameworks have to be pretreated prior to sintering?

Make sure that the frameworks are cleaned. Clean dry frameworks with compressed air and dusty frameworks under running water. The framework **must not** be cleaned with ultrasound in a water bath or the steam jet. Furthermore, it **must not** be blasted with  $Al_2O_3$  or glass polishing beads. The frameworks must be dried prior to the sintering procedure.

#### Can moist frameworks be sintered?

The framework must be dry prior to the sintering procedure. Moist frameworks **must not** be sintered. The drying time depends on the restoration size and temperature (70–140 °C/158–284 °F). Particularly with the Programat S1, there is a high risk of crack development if moist frameworks are sintered.

#### What needs to be observed for the sintering of multi-unit bridges with sinter support structure?

Frameworks with a sinter support structure must be placed lying/upright in the firing sagger. Important: **No  $ZrO_2$  beads** are used in the Sintramat.

#### What is the purpose of the IPS e.max Ceram ZirLiner?

IPS e.max Ceram ZirLiners are translucent. Their three major purposes are as follows:

1. They enable a strong, homogeneous bond to the zirconium oxide framework.
2. They provide the white, unshaded zirconium oxide frameworks with chroma in-depth effect and a shaded character without increasing their opacity.
3. They also provide the non-fluorescent zirconium oxide framework with a natural fluorescence, thus enabling the fabrication of lifelike restorations.

#### Can IPS e.max ZirCAD frameworks be pressed over and/or veneered without the application of IPS e.max ZirLiner?

A suitably shaded IPS e.max Ceram ZirLiner must always be applied. The IPS e.max Ceram ZirLiner generates an outstanding bond and gives the restoration an effect of depth with regard to shade and fluorescence.

#### Why do the IPS e.max ZirCAD Colouring Liquids have a code colour?

The code colour helps to identify if and with which shade a framework was coloured. For productivity-oriented laboratories in particular, this increases the process reliability and helps to check the procedures. Furthermore, the even shading of the framework prior to sintering indicates the correct shading procedure. Handle the liquids with care in order to avoid contamination of skin, clothes or laboratory equipment.

#### Why is the IPS e.max Ceram ZirLiner powder green and how should it be applied?

Since zirconium oxide is white and, therefore, shows a poor contrast to tooth-coloured and/or white powders, the IPS e.max Ceram ZirLiner was given an identification colour to render its application more simple and efficient. The IPS e.max Ceram ZirLiner consists of a very fine powder and appears somewhat thick due to the dense packing of the grains.

Make sure that the material is applied in an even, greenish coat. If the colour appears too pale, the layer is too thin. After firing, however, the ZirLiner demonstrates a layer thickness of approx. 0.1 mm.

**Which IPS e.max Ceram ZirLiner should be used on shaded zirconium oxide frameworks?**

*For shaded zirconium oxide frameworks, use the fluorescent IPS e.max ZirLiner clear. It enables a strong bond to zirconium oxide and endows the framework with a lifelike fluorescence.*

**In which cases is it necessary to conduct a Regeneration firing for IPS e.max ZirCAD?**

*The need for a Regeneration firing depends on the grinding instrument used for finishing the sintered IPS e.max ZirCAD framework. For selecting the grinding instruments, please observe the recommendations for grinding instruments. Basically, the following applies: The finer the grinding instrument, the less damage to the zirconium oxide framework. A Regeneration firing is required if diamond grinding instruments (grain size >100 µm) are used. To remove the sinter support structure in multi-unit bridges, the recommended grinding instruments must be used.*

**Is it possible to control the thickness of the ZirLiner?**

*If the ZirLiner is applied correctly, the shade effect of the fired IPS e.max Ceram ZirLiner corresponds to the IPS e.max Ceram ZirLiner shade guide. If the ZirLiner was applied too thick, the shade effect is too intensive, which may result in shade distortion of the completed restoration.*

**Can furnaces from other manufacturers also be used to sinter IPS e.max ZirCAD restorations?**

*The sinter furnaces Sintramat and Programat S1 are tested for and coordinated with IPS e.max ZirCAD.*

*Other high-temperature furnaces may thus only be used under certain conditions. Please contact Ivoclar Vivadent to learn more about compatible furnaces.*

**May IPS e.max ZirCAD restorations be sand-blasted with Al<sub>2</sub>O<sub>3</sub> prior to veneering?**

*Before veneering, clean the framework with running water or the steam jet. Do **not** blast the framework with Al<sub>2</sub>O<sub>3</sub>, since this may damage the ceramic surface and even jeopardize the bond between the framework and the layering ceramic.*

**Can IPS e.max ZirCAD restorations be conventionally cemented?**

IPS e.max ZirCAD restorations can be cemented adhesively or conventionally. For conventional cementation, however, an appropriately retentive preparation design must be observed. If this is not possible, adhesive luting is preferred, e.g. with Multilink® Automix. Vivaglass® CEM is available for conventional cementation. SpeedCEM is recommended for self-adhesive cementation.

We advise against the use of conventional phosphate cements, since they negatively influence the light transmission through the all-ceramic and therefore compromise the esthetic appearance of all-ceramic restorations. Inlay-retained bridges fabricated in the press-on technique must be adhesively cemented.

# Combination tables

## IPS e.max Ceram (A-D) on IPS e.max ZirCAD

### IPS e.max Ceram on IPS e.max ZirCAD MO 0 (unshaded blocks)

Bleach, A-D	BL1	BL2	BL3	BL4	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4
alternatively	ZL clear				ZL 1	ZL 1	ZL 2	ZL 2	ZL 4	ZL 1	ZL 1	ZL 3	ZL 3	ZL 1	ZL 4					
	-				CL 1 + ZL clear	CL 1 + ZL clear	CL 2 + ZL clear	CL 2 + ZL clear	CL 4 + ZL clear	CL 1 + ZL clear	CL 1 + ZL clear	CL 3 + ZL clear	CL 3 + ZL clear	CL 1 + ZL clear	CL 4 + ZL clear					
IPS e.max Ceram Intensive ZirLiner																				
yellow, orange, brown, incisal																				
IPS e.max Ceram Dentin	BL1	BL2	BL3	BL4	D A1	D A2	D A3	D A3.5	D A4	D B1	D B2	D B3	D B4	D C1	D C2	D C3	D C4	D D2	D D3	D D4
IPS e.max Ceram Transpa Incisal	IBL				TI 1	TI 1	TI 2	TI 2	TI 3	TI 1	TI 1	TI 1	TI 2	TI 1	TI 3					

### IPS e.max Ceram on IPS e.max ZirCAD MO 1 and MO 2 (pre-shaded blocks)

Bleach, A-D	BL1*	BL2*	BL3*	BL4*	A1	A2	A3	A3.5	A4*	B1	B2	B3	B4*	C1	C2*	C3*	C4*	D2*	D3*	D4*		
IPS e.max ZirCAD					MO 1	MO 1	MO 2	MO 2	MO 2	MO 1												
IPS e.max Ceram ZirLiner																						
clear																						
IPS e.max Ceram Intensive ZirLiner																						
yellow, orange, brown, incisal																						
IPS e.max Ceram Dentin					D A1	D A2	D A3	D A3.5					D B1	D B2	D B3	D B4	D C1					
IPS e.max Ceram Transpa Incisal					TI 1	TI 1	TI 2					TI 1	TI 1	TI 1								

\* Please observe the procedure for IPS e.max Ceram on IPS e.max ZirCAD MO 0 (unshaded blocks).

## IPS e.max Ceram Chromascope on IPS e.max ZirCAD

### IPS e.max Ceram on IPS e.max ZirCAD MO 0 (unshaded blocks)

Chromascope	110	120	130	140	210	220	230	240	310	320	330	340	410	420	430	440	510	520	530	540	
alternatively IPS e.max Ceram ZirLiner IPS e.max ZirCAD Colouring Liquid + IPS e.max ZirLiner clear	ZL 1									ZL 2			ZL 3			ZL 4					
	CL 1 + ZL clear									CL 2 + ZL clear			CL 3 + ZL clear			CL 4 + ZL clear					
IPS e.max Ceram Intensive ZirLiner	yellow, orange, brown, incisal																				
IPS e.max Ceram Dentin	D 110	D 120	D 130	D 140	D 210	D 220	D 230	D 240	D 310	D 320	D 330	D 340	D 410	D 420	D 430	D 440	D 510	D 520	D 530	D 540	
IPS e.max Ceram Incisal	I 1	I 1	I 1	I 2	I 2	I 2	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	I 3	

### IPS e.max Ceram on IPS e.max ZirCAD MO 1 and MO 2 (pre-shaded blocks)

Chromascope	110	120	130	140	210	220	230	240	310*	320*	330*	340*	410*	420*	430*	440*	510*	520*	530*	540*	
IPS e.max ZirCAD	MO 1									MO 2											
IPS e.max ZirLiner	ZL clear																				
IPS e.max Ceram Intensive ZirLiner	yellow, orange, brown, incisal																				
IPS e.max Ceram Dentin	D 110	D 120	D 130	D 140	D 210	D 220	D 230	D 240													
IPS e.max Ceram Incisal	I 1	I 1	I 1	I 2	I 2	I 2	I 3	I 3													

\* Please observe the procedure for IPS e.max Ceram on IPS e.max ZirCAD MO 0 (unshaded blocks).

## Drying times

In order to prevent damage to the framework during sintering, the IPS e.max ZirCAD framework must be completely dry. Moist frameworks must not be sintered.

Please observe the following notes for drying:

- The framework must be free of dust and grinding residue.
- The framework can be dried either in a drying cabinet or under an infrared lamp.
- Place the frameworks on the occlusal surface for drying.
- Please note: With infrared lamps (250W), the distance (5–20 cm) to the object directly influences the temperature exerted on the object.
- The drying time depends on the temperature. For drying the frameworks, a temperature of 140 °C (284 °F) must not be exceeded. With lower temperatures, the drying times are prolonged.
- The drying time also varies with the size of the framework. The following table contains the corresponding drying times.

### Drying times for IPS e.max ZirCAD depending on the restoration size and temperature

	Temperature ~70 °C (158 °F)	Temperature ~140 °C (284 °F)
Single-tooth frameworks	≥15 min	5-10 min
3-4-unit bridge frameworks	≥40 min	≥25 min
5- and more-unit bridge frameworks	≥50 min	≥25 min

## Regeneration firing – Firing parameters

- Clean and dry the framework with a steam jet.
- Position the framework on metal pins on a honey-combed tray, or direct on the sinter tray if Programat S1 is used.
- Conduct the Regeneration firing in a ceramic furnace (e.g. Programat P700 or the sinter furnace Programat S1) using the respective parameters.
- As an option, a regular sinter firing in the Sintramat (Program P1) can be conducted again.

### Firing parameters for the IPS e.max ZirCAD Regeneration firing in the ceramic furnace or the sinter furnace Programat S1

Furnace	B °C/°F	S min	t <sub>1</sub> ↗ °C/°F	T <sub>1</sub> °C/°F	H <sub>1</sub> min	L °C/°F	t <sub>2</sub> ↘ °C/°F
P300 P500 P700 EP 3000 EP 5000	403 757	0:18	65 117	1050 1922	15:00	750 1382	25 45
P80 P100 P200 EP 600	403 757	0:18	65 117	1050 1922	15:00	750 1382	—
PX1	403 757	0:30	65 117	1050 1922	15:00	750 1382 12 min	—
S1	Regeneration firing program 7						

## Firing parameters for IPS e.max ZirCAD

### Firing process for zirconium oxide-supported restorations

In order to obtain optimum firing results for IPS e.max Ceram, the following points have to be observed:

- In order to ensure an even thickness of the veneer, the zirconium oxide framework must be designed in such a way that it supports the cusps. Depending on the clinical situation, the results are different wall thicknesses and dimensions of the framework.
- Since ZrO<sub>2</sub> is a poor heat conductor compared to other framework materials, a low **temperature increase rate t<sub>r</sub>** is required. This ensures even heat distribution in the bonding area between the framework and the veneer, as well as the outer surfaces of the restoration even with different framework thicknesses. In this way, an optimum bond as well as even sintering of the layering materials are achieved.
- During cooling of the restorations after firing, stress occurs as a result of the different cooling speed at the outside and within the material. With **long-term cooling L** for the “final firing cycle” this stress can be reduced and the risk of delamination minimized, particularly in ZrO<sub>2</sub>-supported restorations.
- Multiple units (e.g. multi-unit bridges with massive bridge pontics) in the furnace delay even heating of the objects to be fired.
- The heating of the firing chamber depends on the type of furnace as well as the size of the firing chamber.
- The parameters stipulated in the Instructions for Use are coordinated with Ivoclar Vivadent furnaces (tolerance range +/- 10°C/18°F).
- If a non-Ivoclar Vivadent furnace is used, temperature corrections may be necessary.
- At the beginning, open the furnace and wait for the acoustic signal. Subsequently, place the firing tray with the objects in the centre of the firing table and start the program.



### Notes on cooling after completion of the firing program

In order to ensure “smooth” cooling of the restoration after firing, please observe the following notes:

- Wait for the acoustic signal or optical indication of the furnace at the end of the firing cycle before the firing tray with the fired objects is removed.
- Do not touch the hot objects with metal tongs.
- Allow the objects to cool to room temperature in a place protected from draft.
- Do not blast or quench the objects.

### IPS e.max Ceram on IPS e.max ZirCAD

IPS e.max Ceram on IPS e.max ZirCAD Layering Technique	B °C/°F	S min	t <sub>r</sub> °C/°F/min	T °C/°F	H min	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing	403/757	4:00	40/72	960/1760	1:00	450/842	959/1758	0
1 <sup>st</sup> Margin firing	403/757	4:00	40/72	800/1472	1:00	450/842	799/1470	0
2 <sup>nd</sup> Margin firing	403/757	4:00	40/72	800/1472	1:00	450/842	799/1470	0
Wash firing (Foundation)	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
1 <sup>st</sup> Dentin / Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
2 <sup>nd</sup> Dentin and Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
Stain Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On with Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On after Glaze Firing	403/757	6:00	50/90	700/1292	1:00	450/842	699/1290	450/842



### IPS e.max Ceram on IPS e.max ZirPress/ZirCAD (Staining Technique)

IPS e.max Ceram on IPS e.max ZirPress <i>Staining Technique</i>	B °C/°F	S min	t↗ °C/°F/min	T °C/°F	H min	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing - before wax-up and pressing	403/757	4:00	40/72	960/1760	1:00	450	959/1758	0
Stain and Characterization Firing	403/757	6:00	60/108	770/1418	1:00-2:00	450	769/1416	450/842
Glaze Firing	403/757	6:00	60/108	770/1418	1:00-2:00	450	769/1416	450/842
Add-On after Glaze Firing	403/757	6:00	50/90	700/1292	1:00	450	699/1290	450/842



### IPS e.max Ceram on IPS e.max ZirPress/ZirCAD (Cut-Back, Layering Technique)

IPS e.max Ceram on IPS e.max ZirPress <i>Cut-Back and Layering Technique</i>	B °C/°F	S min	t↗ °C/°F/min	T °C/°F	H min	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing - before wax-up and pressing	403/757	4:00	40/72	960/1760	1:00	450/842	959/1758	0
Wash firing (foundation)	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
Wash firing (foundation) characterization	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
1 <sup>st</sup> Dentin / Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
2 <sup>nd</sup> Dentin / Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	0
Stain Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On with Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On after Glaze Firing	403/757	6:00	50/90	700/1292	1:00	450/842	699/1290	450/842



### IPS e.max Ceram on IPS e.max ZirPress/ZirCAD (Gingiva Technique)

IPS e.max Ceram on IPS e.max ZirPress <i>Gingiva Technique</i>	B °C/°F	S min	t↗ °C/°F/min	T °C/°F	H min	V <sub>1</sub> °C/°F	V <sub>2</sub> °C/°F	L °C/°F
ZirLiner firing - before wax-up and pressing	403/757	4:00	40/72	960/1760	1:00	450/842	959/1758	0
Wash firing (foundation)	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	450/842
Wash firing (foundation) characterization	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	450/842
1 <sup>st</sup> Dentin / Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	450/842
2 <sup>nd</sup> Dentin / Incisal firing	403/757	4:00	40/72	750/1382	1:00	450/842	749/1380	450/842
Stain Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On with Glaze Firing	403/757	6:00	60/108	725/1337	1:00	450/842	724/1335	450/842
Add-On after Glaze Firing	403/757	6:00	50/90	700/1292	1:00	450/842	699/1290	450/842

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### **Date information prepared: 02/2010**

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