



INSTRUCTION MANUAL



www.cgiporcelain.com



CGI DENTAL PORCELAIN

INSTRUCTION MANUAL

CHARACTERISTICS

1. Great modeling ease, especially suitable for laboratories in which speed and accuracy are top priority.
2. Easy to use for the ceramist with little experience but with all of the properties and porcelains necessary for the expert ceramist.
3. Immediate and accurate shade matching with the mere application of opaque/dentine/incisal layering; color stability even for varied thickness.
4. Extremely stable linear expansion coefficients during subsequent firing processes; safely withstands up to six firing cycles.
5. Minimum shrinkage.
6. Great translucency and color depth.
7. Opaque, Dentine, and Opacious Dentine available in all shades A0 – D4.
8. Wide color range of shades, Opaque Modifiers, Dentine Modifiers, Incisals, and 18 Paste Stains.
9. “Live” and natural fluorescence in all light conditions.

CGI is the product to use for:

- Porcelain Fused to Metal (PFM) Crowns and Bridges

NOTES ON ALLOYS AND FRAMEWORKS

1. FABRICATION OF THE MODEL AND DIE

During model and die preparation, keep in mind that porcelain fused to metal restorations require a minimum thickness of 1.5 to 1.8 mm of which 0.3 to 0.5 mm is the metal portion. The model can be prepared using the desired technique. Remember that the use of shoulder porcelain requires a proper shoulder preparation.

2. THE METALLIC FRAMEWORK

- 2.1. The modeling of the metallic framework can be performed with the desired technique. The space reserved for the ceramic covering should not be less than 0.8 mm. The ceramic layer should not exceed 2 mm in thickness on the incisal borders to avoid the risk of fractures.
- 2.2. Avoid creating sharp corners, indentations, angles or curved edges on the metal surface that is to be covered. Every sharp corner is a potential point of origin for fractures, while every indentation could cause defects in the ceramic fusing process or fractures due to the contraction that occurs during firing.
- 2.3. The ceramic must be well supported by the metal, especially in the areas of contact with the opposing dentition. In order to avoid fractures or separations, the points of contact between ceramic and metal should not coincide with the points of contact between opposing surfaces. At the same time, metal structures that are extremely open must offer great flexural stability, keeping in mind the necessary aesthetic and hygienic considerations, because any possible bending that might occur will cause fractures or separations of the ceramic.
- 2.4. It is possible to create complete or extensive arches in a single casting, but they should be made capable of withstanding lateral or flexural movements by way of a stabilizing bar that is sufficiently wide and can be left in place until the final glazing of the ceramic has been completed.
- 2.5. The surface of the metal structure that is to be covered must be perfectly clean, degreased and free of faults or porosity. It is recommended to use abrasives in aluminum oxide with a ceramic binder or carbides. Always grind or refinish in the same cutting direction of the instrument, without intersecting the cutting lines on the metallic structure. The finished and sanded structure must be washed with water using clean brushes. Avoid using oily substances such as soaps. Degrease with moderately acidic liquids or with a jet of steam.

3. CHOOSING THE ALLOY

- 3.1. In general, most of the alloys used for ceramic fused to metal restorations are compatible with CGI porcelains. However, since every alloy reacts differently with respect to the coefficient of expansion and can sometimes be unpredictable beyond the officially published data, we suggest that you utilize the alloys recommended for the product with a CTE in the range of $14.0 - 14.4 \times 10^{-6}/^{\circ}\text{C}$, measured in the range of $25 - 500^{\circ}\text{C}$.
- 3.2. A practical compatibility test can be performed in the laboratory. Put a framework of at least six units through a minimum of six firing cycles. If there are no signs of cracks or fractures by the sixth firing cycle, the alloy is almost definitely compatible even with borderline operations.
- 3.3. If you should have any doubts about the alloy to use, contact Ceragroup Industries or your CGI distributor for more detailed information.
- 3.4. Be careful when re-casting alloys because in many cases this gives rise to substantial and unpredictable alterations in the expansion coefficient. Therefore, it is best not to add more than 50% of re-melted alloy to the new casting. It is also important to place the alloy in the crucible in such a way that during casting, the two alloys meld together while entering into the investment.
- 3.5. The linear coefficient of thermal expansion of CGI is included in the interval $12.60-13.0 \times 10^{-6} /^{\circ}\text{C}$ for all porcelains (25-500 °C, Opaques, Dentines and Incisals).
- 3.6. The glass transition temperature is between 480-500 °C for all CGI porcelains.

4. DEGASSING / OXIDATION

- 4.1. It is fundamental that the alloy go through a phase of heat degassing or oxidation in the oven muffle. Careful attention must be paid during the degassing of palladium-silver alloy, even though the manufacturer might state that oxidation is not necessary.
- 4.2. Always verify that the oxidation layer is sufficient but not excessive as a layer that is too thick compromises the porcelain-metal bond and becomes a potential separation point of the interfaces.

5. ALLOYS CONTAINING SILVER

- 5.1. Alloys containing a high percentage of silver may generate discoloration phenomena resulting in a greenish shade to the porcelain. This is caused by the volatilization of some silver oxides that tend to attach themselves onto the porcelain and on the refractory material of the oven muffle and recirculate during successive firing cycles. In order to avoid this occurrence, be sure to decontaminate the oven periodically (at least once a week).
- 5.2. CGI porcelains are manufactured with a non-greening chemistry, however, in order to increase safety levels, it is wise to adopt a specific program of muffle decontamination, closely adhering to the oven manufacturer's instructions.
- 5.3 Alloys should be sandblasted using Aluminum Oxide of 100-110 microns in order to clean the surface of the alloy and to better create an adequate mechanical bond.

WORK TECHNIQUE

1. TREATMENT OF MIXTURES AND MODELLING

- 1.0. CGI porcelain can be mixed and modeled using the desired techniques, including condensed onto the model, pre-vibrated onto a mixing slab, pre-condensed onto a mixing slab and brush or spatula modeled.
 - 1.1. During the preparation and working of the porcelain powder, remember that certain actions can lead to modifications of some of the material's characteristics.
 - 1.1.1 The porcelain should be mixed and moistened on a flat surface and not inside of deep wells. When mixed in the well, the liquid tends to deposit itself on the bottom, pulling with it finer particles and color pigments. This can modify the condensation characteristics of the porcelain as well as the resulting color.
 - 1.1.2 The drying of the liquid in excess after mixing should never be done from above, but always from the side of the moistened powder body. The liquid emerges due to capillary action, pulling with it finer particles and color pigments. Drying from above by way of absorption draws up the finest particles, which are principally responsible for the natural glaze, and modifies the porcelain's coefficient of thermal expansion.
 - 1.1.3 Drying of the restoration that is being modeled after condensation should always be done from the lower edge by simply dabbing it with the absorbent material. In this case, the ceramic powder itself acts as a filter, entrapping the fine particles and allowing only the liquid to flow out due to capillary action.

- 1.1.4 The dried porcelain can always be remoistened with either distilled water or Modeling Liquid and condensed for additional modeling. Remix the dried mixtures carefully.
- 1.2. The more pre-condensed is the porcelain on the mixing slab, the greater the handling qualities. There are substantial advantages in modeling drier and pre-condensed porcelain:
 - It reduces condensation on the framework, which is always dangerous for the granulometric integrity, the coefficient of thermal expansion, the auto-glazing capacity and the chromatic qualities of the porcelain.
 - It increases the compactness of the porcelain, which results in better translucency and greater hardness.
 - It reduces contraction during firing, which avoids excessive over modeling of the restoration.
- 1.2.1 However, it is not always possible to keep to a strong pre-condensation, especially when complex aesthetic treatment is foreseen, creating the need for chromatic layers and supports that are differentiated in depth as well as in extension. In all of these cases, there are no contraindications in adapting the fluidity of the mixture to the work being done.
- 1.2.2 Whenever possible, however, it is recommended to work in accordance with the instructions given above. At least partial pre-condensation of the powder, careful drying at the side or lower edge so as not to lose granulometric consistency and coloring pigmentation, and preparation on flat surfaces instead of bowls, will result in more consistent, higher quality restorations.
- 1.3. If you should prefer to model with a spatula, it is recommended to proceed with porcelain that has been condensed and brought to the proper level of compactness on the mixing surface.
- 1.3.1 The optimal state in which the porcelain should be mixed for modeling is well condensed and dried, plastic and pliable without being runny.

2. METAL CONDITIONER

- 2.1. Met-Con is a bond enhancer and color controller designed for optional use with alloys that produce excessive oxides. Met-Con is compatible with all CGI porcelains.

- 2.2. Either expel Met-Con Paste from the syringe or mix the Met-Con Powder and Liquid to a thin slurry and apply to the surface that will receive the porcelain. A thin even coat should be applied. Dry slowly at the muffle until a white chalky surface appears. Fire according to the recommendations in the CGI firing chart.

3. APPLICATION OF THE OPAQUES

- 3.1. CGI Opaques are available in powder and an extremely fine grain, smooth and ease to apply paste that is suitable for PFM and POM techniques.
- 3.2. In addition to its functions of opacifying and bonding to metal, the opaque provides the fundamental color for the fixed prosthetic restoration. The proper, complete and uniform layering of the opaque is therefore a primary premise for the final chromatic result.
- 3.3. In general, the lighter the opaque, the more light that will be reflected on the treated surface. The final color will be more luminous and will seem lighter. The darker the opaque, the more the final chroma will be heightened, at the expense, however, of an increased opacity, resulting in a color that seems more saturated. For this reason, modest but interesting variations in base color value can be obtained by substituting or flanking, within the same color dominant, a lighter shade of opaque with a darker shade and vice versa ie: substituting completely or in limited areas the Opaque A3 with the Opaque A2 (lighter) or A4 (darker). Only after much practical color experience, however, will it be possible to opaque dominants as the color result is difficult to predict.

The opaquing system begins with MASK, a first coat ceramic material with exceptional masking abilities that is available in paste or powder packaging.

- 3.4. There are 18 additional opaque porcelains, one for each dentine shade A0 – D4, available in both powders and pastes. CGI opaques are the foundation of the shade and therefore are in the same color range as the dentines and opacious dentines.
 - 3.4.0 When using the MASK powder in a spray application, an extremely fine layer will produce excellent results. Spraying on this first layer is best accomplished with the restoration still on the die(s) to eliminate the need to remove opaque form the inside of any coping. CGI opaque powders are the finest grain opaque powders available. This allows complete coverage with a very thin layer.
 - 3.4.1 MASK is a neutral opaque material with a composition which allows it to be used as a first opaque layer under all shades other than A0 or B0, creating a thin but effectively masking wash opaque layer.

- 3.4.2 Opaque or MASK powder can be mixed with distilled water. However, this is best done with CGI Opaque Liquid to provide the creamiest most homogeneous mix possible. Because CGI opaques are very fine grain opaques they can be applied in a thicker layer and will fire to a very thin but opacifying coverage.
- 3.4.3 If using opaque or MASK paste, expel from the syringe and mix the paste to a homogeneous consistency using a glass spatula. If it is determined that the paste consistency needs to be thinned, mix with a very small amount of Paste Liquid, Apply over the metal with a glass instrument or a brush pre-moistened with CGI Paste Liquid.
- 3.4.4 Layer the opaque, vibrating slightly to obtain a good contact. Place into muffle area at a muffle temperature no higher than 600°C for powders or 400°C for pastes. Dry and fire according to the firing chart indications for opaques. Allow the restoration to cool and treat it with a jet of steam.
- 3.4.5 Mix the opaque in a creamier or denser way and apply it as a second layer with the proper brush or glass instrument. With a well-coated brush or instrument, allow the material to slide onto the framework, vibrating very gently to obtain a uniform and homogeneous flow. Be certain that the distribution is homogeneous and that all of the metal is well coated. After firing, the metal structure should not be visible. Should this not be the case, retouch and perform a third firing cycle. Any sort of correction or addition can be made on a layer of dry unfired opaque by re-moistening the dry surface. The second opaque layer, either powder or paste, should be applied in the same fashion but applied as a thicker, creamier coat.
- 3.4.6 In the case of non-precious alloys, you may model the opaque body about 1 mm beyond the metallic margin to avoid the formation of dark oxidation borders. Reduction should be performed only after the final firing. A thickness of about 0.2 mm is necessary to obtain a good opacifying and color effect.
- 3.4.7 Do not use excess liquid for wetting the brush or to alter the consistency because this will detrimentally affect the handling of the paste. Do not be afraid of applying a thick layer of paste. Once the paste is dried and fired, the final thickness of two layers of opaque will be less than 0.2 mm.

3.5. Opaque Modifiers:

The following Opaque Modifiers are available in both powder and paste:

- | | | | |
|---------|----------|---------|----------|
| - Brown | - Ocher | - Pink | - Yellow |
| - Gray | - Orange | - White | |

3.6 SPRAY OPAQUE FOR AIRBRUSH APPLICATION

Mix powder and liquid to the desired ratio in order to provide the correct consistency for the airbrush system. Adjust the inlet pressure and nozzle settings recommended by the airbrush manufacturer. Shake or mix the jar prior to connection to the airbrush to assure a homogeneous mix. Apply a thin even layer over the surface to be opaqued. Proceed to dry and fire as per firing instructions. The liquid for the spray is not provided. It is recommended to use any commercial liquid available or Isopropyl alcohol (2-propanol). Spray a second coat to improve the coverage of the alloy. Fire according to instructions.

4. SUGGESTED LAYERING

- 4.1. Due the excellent translucency of CGI porcelains, proper shade can be obtained even in cases of minimal reduction of the preparation. With the desired 1.5mm of space, accurate shades can be obtained exclusively with the Opaque, Dentine, and Incisal porcelains. In case of limited reduction of the preparation the use of Opacious Dentine allows for excellent shade matching with reduced porcelain thickness. Please see the illustrations and photos below and follow the appropriate layering techniques depending upon available space. In order to obtain a good color result, the layering should have a minimum thickness of 1.2 to 1.3 mm (in addition to the thickness of the opaque layer) and about 2 mm overall in the occlusal and incisal areas. Lesser thicknesses create the need to reinforce the color with modifiers.
- 4.2. This layering is simple and immediate and allows for considerable savings of time and high productivity, if all work instructions are followed perfectly, particularly those regarding handling and firing procedures. Any variation in the recommended methods could bring about possible color modifications, which would result in a more complicated subsequent layering for shade attainment.
- 4.3. If an advanced chromatic operation is planned, one can create as complex a layering scheme as desired. Even in these cases, the loss of simplicity in the work will be amply compensated by the aesthetic results obtained.
- 4.4. CGI porcelain has an extremely small sintering contraction or shrinkage (up to 12% if modeled from pre-condensed mixes). Overbuild slightly to compensate for dimensional sintering contraction, but not excessively, especially if you are using the spatula technique. The brush technique, when used with porcelains that are not pre-condensed, causes a slightly higher sintering contraction.

- 4.5. Always insulate the parts of model that could have potential contact with the porcelain to be modeled, preventing the stone model from absorbing the Modeling Liquid.
- 4.6. If the entire form of the crown is built with dentine, cut back for the incisal layer, being careful that all of the edges are well blended to obtain gradual and coordinated chromatic passages.
- 4.7. The occlusal surfaces of molars and premolars must have profiles that are not excessively pronounced or sharp. Mastication produces forces that, when applied in the direction of the cut, can lead to a premature fracturing of the ceramic. The optical plasticity should be sought instead through substitute chromatics like the use of “cold” colors on the walls of the fossa or dark colors on the inside of the profiles of the fossa.

5. DENTINE AND INCISAL PORCELAINS

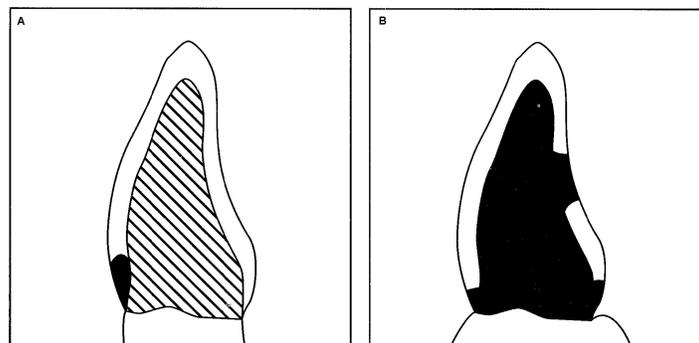
5.1. Dentine porcelains:

There are 18 dentine porcelains, one for each shade A0 – D4

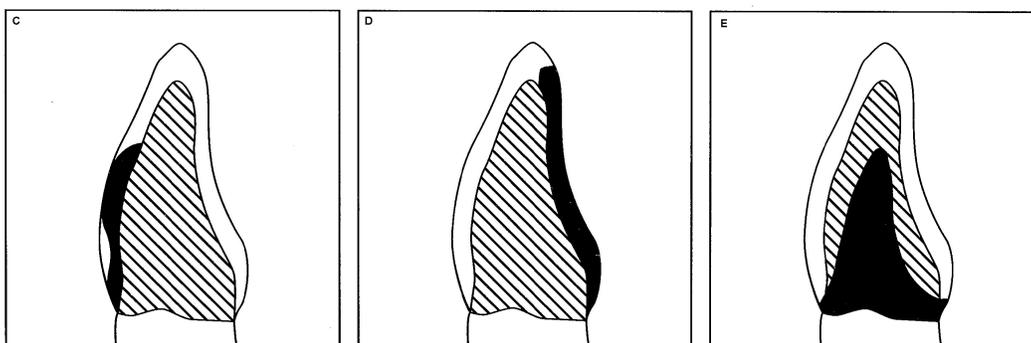
5.2. Opacious Dentines:

There are also 18 opacious dentines, one for each shade A0 – D4. They possess such a good opaquing capacity that they can be used when the base opaque appears too evident or in those modeling areas that are chromatically critical.

Note: Differences in color and appearance may be noted between the restoration on the model and in the mouth, particularly when the intraoral illumination of the



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- A. Thin dentine areas, especially those close to the margin. In these areas, a layer of opacious dentine can be modeled in order to avoid chromatic variations in relation to the other areas of the tooth.
- B. Sub gingival areas of the restorations. In these areas, a layer of opacious dentine can be modeled in order to reproduce the exact color and reduce the shadow effect due to the presence of the gingiva and to the scarce quantity of light present.
- C. Central labial areas. In these areas, a good layering of opacious dentine allows for interesting chromatic effects permitting the reproduction of secondary pigmentation without affecting the overall chromatic character of the restoration.
- D. Inter dental spaces. The use of a layering of opacious dentine in these zones lends a more natural appearance to the restoration through better light reflection and a reduction of the shadow effect.
- E. Posterior zones (lingual and palatal). A layering of opacious dentine helps to camouflage the presence of visible metal collars.

5.4. Incisal Porcelains:

The incisal porcelains are highly translucent as compared to dentine porcelains. During the layering process, remember that the chromatic effect of the incisal porcelain is that of reducing the color saturation of the dentine while increasing luminosity. It is critical to remember that a general incisal layering of the surface of the restoration leads to an overall grayish appearance. CGI dentine porcelains are highly translucent and when covered with the more translucent incisals, the effect is a grayish appearance. Therefore when a more saturated or intense color is desired, apply the incisal only to the incisal third of the restoration. Apply incisal porcelains in very thin layers. If a greater luminosity is desired or less dentine color saturation, apply the incisal in thicker layers.

5.4.1 Six high translucent incisal porcelains are recommended to be used according to the following chart:

DENTINE	INCISAL
A0 and B0	Bleach
A1, B1, C1 and D2	Clear
A2, B2 and D3	Extra light
A3, C2 and D4	Light
A3.5, B3, B4 and C3	Medium

- Gum Shade Light, Medium and Dark

- 7.3. Stains are to be used alone or in a combination with the glazes. They should be fired according to the tables given.
- 7.4. ALL CGI stains and glazes can be used and are compatible with all dental ceramic materials including pfm ceramic, lithium silicates and zirconia materials.

8. GLAZING AND CORRECTION

8.1. Glazes:

Glazing gives the tooth a greater surface shine that is moist and silky and appears similar to the surface of natural dentition.

Glazes are available in both powder and paste as:

- Universal Glaze
- Universal Fluorescent Glaze

- 8.1.1 Glaze powder must be mixed with Stain and Glaze Medium. Mix a small quantity, and apply an extremely thin layer onto the restoration.
- 8.1.2 Glaze Pastes may be mixed on the mixing slab or applied directly to the restoration using a brush moistened with Stain and Glaze Medium.
- 8.1.3 Glaze must be fired according to the appropriate cycle on the firing chart.
- 8.2. After all the necessary morphological corrections have been made, polish using the desired instruments or polishing paste appropriate for porcelain. Add or correct any morphological effects or characterizations. Expel the selected Glaze Paste or mix the selected powder into a creamy and fluid consistency and apply a very fine layer with a brush. During this procedure, stains can be layered alone or mixed with the glaze. Slowly place the restoration into the oven and fire without engaging vacuum according to the firing chart.
- 8.3. Correction with Add On porcelain

Seven Add On porcelains are available:

- Dentine Light
- Dentine Medium
- Dentine Dark
- Incisal Clear
- Incisal Light

- 8.4.1 If it is necessary to make slight corrections after the final firing procedures, CGI Add On correction porcelain can be used. Firing can be done at the same time as that of the Universal Glaze without vacuum. CGI Add On must only be used in small quantities. When placed in the contact area, they tend to harmonize chromatically with the adjacent porcelain.
- 8.4.2 Treat the concerned surfaces with an abrasive and wash carefully. Apply the correction porcelain mixed with Modeling Liquid, keeping in mind the firing shrinkage. Fire according to the chart with or without vacuum as preferred. The surface appearance will be shiny and will harmonize with any previously glazed surface. Pay attention to the previously prepared glaze while polishing the newly prepared one.

9. MIXING AND MODELLING LIQUIDS

The following mixing and modeling liquids are available:

- Met-Con Liquid: a special liquid used in the mixing of Met-Con metal conditioner.
- Opaque Liquid: a special liquid to be used in the mixing of opaque powders. When used, this liquid will provide an opaque powder mix that is creamier and easier to apply the metal.
- Modeling Liquid: a special liquid for use with dentine and incisal porcelains to enhance the building and modeling of the ceramic as well as improving the density of the fired restoration.
- Stain and Glaze Medium: a special liquid to be used only with glaze and stain.
- Paste Liquid: a special liquid that can mixed with opaque powders to form a more paste like mix and also used for moistening the brush for enhancing the application of paste opaques.

SINTERING (FIRING PROCESS)

1. NOTES ON THE FIRING PROCESS

- 1.1 The temperature instructions given are guidelines. Porcelain is a mineral substance that does not have a clearly defined maturation point, but has a maturation interval.

- 1.2 Each technician must decide which level of porcelain maturation is most suitable for his or her style. Properly matured porcelain has a fine eggshell surface texture and a good luster. If the surface texture is opaque, soft or granular, the sintering temperature was too low. If the surface is too smooth and too lustrous, the sintering temperature was too high and the color will lack strength or be too light. The technician must acquire familiarity with optimal temperature needed for his or her oven and working habits, following the guidelines for each specific porcelain as established in the CGI firing chart.
- 1.3 CGI dentine and incisal porcelains display an excellent level of sintering maturity in the interval of 935-940 °C.
- 1.4 If the porcelain is fired to perfection, that is, if it displays a glossy, fine, eggshell texture, it is possible to omit the glazing procedure or simply move on to natural glazing. If the porcelain is fired at a slightly lower or slightly higher temperature, the natural glaze may not be sufficient and the appropriate glazing porcelain can be used.
- 1.5 Opaques require a slightly higher temperature (977°C). Glazes and correction porcelains, on the other hand, require lower temperatures (800°C).
- 1.6 Do not fire the opaque at a temperature that is too low or the coloring pigments do not mature properly and the chromatic yield can vary greatly.
- 1.7 Do not insert the porcelain at a temperature that is too high. The immediate vitrification of the surface layers will inhibit the emission of air, leaving porosity that will cause color variations and structural weaknesses in the restoration.
- 1.8 Do not fire additional layers of porcelain at temperatures that are too low. Always fire at the same temperatures for the same porcelains.
- 1.9 Do not fire the porcelain at a temperature that is too low out of caution of for safety reasons. The porcelain must arrive at perfect maturity in order to fully offer all of its chromatic characteristics.
- 1.10 Do not impose rates of temperature increase that are too high or the coloring pigments will not have the time to mature and the color yield will be imperfect.
- 1.11 Always air cool CGI porcelain by immediately opening the oven and directly removing the restoration upon completion of the firing cycle. Slow cooling raises the coefficient of expansion and pushes CGI porcelain beyond the predisposed values for the product.

- 1.12 The maximum number of firing processes that can be performed safely is six. Beyond this limit, it is best to work CGI Add On porcelain.

2. PORCELAIN FURNACE

- 2.1 CGI porcelains can be fired in all porcelain furnaces with temperature levels and rates of temperature increase that are compatible with the CGI firing chart.
- 2.2 Every furnace possesses its own characteristics, even identical products, especially after a long period of use. Different series of the same model vary in temperature calibration, muffle characteristics and heating elements, in addition to rates of temperature increase. The maturation of the porcelain is based on time and temperature. Every furnace will behave in a slightly different way regarding porcelain maturation. The firing temperatures, are only suggested temperatures. It is important to familiarize yourself with the optimal temperature necessary for your oven, without, however, adopting this temperature as an absolute value for other furnaces.
- 2.3 As has already been indicated, the phenomenon of greenish discoloration caused by alloys containing silver arises from the volatilization of silver components that attach themselves to the inner coating of the furnace. If alloys containing silver are used, decontaminate your furnace periodically (at least once a week) following the manufacturer's instructions.

3. STANDARDS

CGI porcelains meet the following standards:

ISO 6872/95 Dental Ceramic.
ISO 9693/99 Metal-ceramic restorative systems.

- **Uniformity:** no segregation of the pigments shall take place when the powder is mixed with the recommended liquid.
- **Freedom from extraneous materials:** material shall be free from extraneous materials when assessed by visual inspection.
- **Radioactivity:** Ceramic shall have a radioactive emission of not more than $0.2 \text{ Bq}\cdot\text{g}^{-1}$ of U238.
- **Flexural strength:** minimum 50 MPa.

- **Chemical solubility:** Loss in mass, 100 $\mu\text{g}/\text{cm}^2$ max.
- **Adhesion to alloys:** The adhesion between the ceramic and at least one specified metallic material shall be greater than 25 MPa.

4. TECHNICAL DATA

- **Radioactivity:** There are no radioactive elements in CGI porcelains compositions. The total radioactivity is less than 0.2 Bq-g⁻¹ of U238.
- **Toxic or harmful elements:** CGI porcelains are completely free of Lead, Uranium, Antimony and Cadmium.
- **Flexural strength:** 125 MPa with a standard deviation of 10 MPa.
- **Chemical solubility:** 55 $\mu\text{g}/\text{cm}^2$.
- **Adhesion to alloys:** 36.8 MPa as tested with CERAKAST 1 non-precious.
- **Linear thermal expansion coefficient:** Opaque: after two firings: $13.0 \times 10^{-6}/^{\circ}\text{C}$; after four firings: $13.2 \times 10^{-6}/^{\circ}\text{C}$ (25-500°C).
- **Dentine and Incisal:** after two firings: $13.0 \times 10^{-6}/^{\circ}\text{C}$; after four firings: $12.9 \times 10^{-6}/^{\circ}\text{C}$ (25-500°C).
- **Glass transition temperature:** Between 590-742°C for all CGI porcelains.
- **Particle size distribution:** Opaque: d50= 5.0 μm
Dentine and Incisal: d50=25.0 μm
- **Specific gravity:** 2.7 g/ml.

CGI COLOR COMBINATION TABLE

<i>DENTINE</i>	<i>A0</i>	<i>A1</i>	<i>A2</i>	<i>A3</i>	<i>A3.5</i>	<i>A4</i>	<i>B0</i>	<i>B1</i>	<i>B2</i>
<i>OPAQUE</i>	A0	A1	A2	A3	A3.5	A4	B0	B1	B2
<i>OP. DENTINE</i>	A0	A1	A2	A3	A3.5	A4	B0	B1	B2
<i>INCISAL</i>	Bleach	Clear	X Light	Light	Medium	Dark	Bleach	Clear	X Light

<i>DENTINE</i>	<i>B3</i>	<i>B4</i>	<i>C1</i>	<i>C2</i>	<i>C3</i>	<i>C4</i>	<i>D2</i>	<i>D3</i>	<i>D4</i>
<i>OPAQUE</i>	B3	B4	C1	C2	C3	C4	D2	D3	D4
<i>OP. DENTINE</i>	B3	B4	C1	C2	C3	C4	D2	D3	D4
<i>INCISAL</i>	Medium	Medium	Clear	Light	Medium	Dark	Clear	X Light	Light

	CGI DENTAL PORCELAIN FIRING CHART				
	Opaque 1st Firing	Opaque 2nd Firing	Dentines/ Incisals	Add On	Stains and Glazes
Dry out	Powder 5 min Paste 7 min	Powder 5 min Paste 7 min	5 min.	5 min.	3-5 min.
Insertion	593°C 1100°F	593°C 1100°F	593°C 1100°F	515°C 960°F	300°C 572°F
Heat rate ° / min.	50°C 90°F	50°C 90°F	50°C 90°F	55°C 100°F	40°C 72°F
Vacuum start	593°C 1100°F	593°C 1100°F	593°C 1100°F	Optional	None
Vacuum stop	977°C 1790°F	940°C 1724°F	927°C 1700°F		None
Firing Temp.	977°C 1790°F	940°C 1724°F	927°C 1700°F	800°C 1470°F	750°C - 850°C 1382°F - 1562°F
Hold Time	1 Minute	1 Minute	1 Minute	1 Minute	1 Minute
Cool Time	0	0	1-5 min	0	0
Texture	Semi-Gloss	Eggshell-Shiny	Grainy-Shiny	Glossy	Glossy
Thickness (approx.)	Thin Wash	0.1-0.3 mm	0.5-1.0 mm		

* The above temperatures are recommended and can vary with individual furnaces and the type of tray used during the firing. The crucial factors for the firing temperatures are the appearance and the surface condition of the restoration after the firing process.

Recommended alloy CTE range : **14.0-14.4** x 10⁻⁶ /°C @ 500°C



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