PRODUCER OF SPECIAL ALLOYS SINCE 1975

MEDICAL DENTAL ALLOYS: MAGNUM SOLARE

MAGNUM SOLARE: COBALT-CHROMIUM FOR MILLING

Protocol for Preparation and Use

Magnum Solare is a **medical-grade Cobalt-Chromium metal alloy** with outstanding characteristics. Thanks to its low Vickers hardness (**255 HV10**), it ensures reduced tool wear, allowing for high and long-lasting precision during the milling process of the restoration. This also minimizes the workload on the CNC milling machine, particularly on the spindle.

However, like any metal, Magnum Solare is subjected to forces during the mechanical material removal process, which can generate internal stresses. For this reason, it is essential to follow a proper protocol to ensure dimensional stability and the overall quality of the final restoration.

1st STAGE: THERMAL STRESS RELIEF

Working Parameters

- 1030°C for 7 minutes (from 1 to 3 elements)
- 1030°C for 12 minutes (over 3 elements)

What is Thermal Stress Relief and What is Its Purpose?
The heat treatment of Cobalt-Chromium is designed for **stress relief**, an essential process to eliminate residual tensile and compressive forces within the metal structure after machining. The treatment involves heating the workpieces to a temperature at which the material exhibits a very low yield strength. At this temperature, residual stresses are reduced through micro-viscous flow movements within the material until they become negligible. This process is crucial to ensure the following benefits:

- **Preservation of geometric stability** during subsequent processing
- **Increased fatigue resistance of the material,** reducing the risk of crack propagation

⚠ ***Warning**: The stress relief temperature must not exceed the tempering temperature of the material (1030°C for this application) to prevent an inevitable loss of the material's mechanical properties.*

⚠ ***Welding Considerations**: When welding heterogeneous materials on the same restoration (e.g., Nickel-Chromium welds), it is crucial to take into account their different thermal expansion coefficients. Differences in thermal expansion can lead to localized shrinkages, residual localized stresses, geometric deformations and, in severe cases, crack formation.*

2nd STAGE: OXIDATION

Working Parameters

- 980 C° for 2 minutes

What is Oxidation and What is Its Purpose?
Oxidation is a natural phenomenon that occurs when a metal combines with oxygen, forming a superficial oxide layer. During this process, the metal undergoes electron loss due to the higher electronegativity of oxygen.
Oxidation always involves energy release, in this case in the form of heat. The process is carefully controlled to achieve an optimal surface condition for the subsequent ceramic layering. This process is crucial in the dental field because:

- **Enhances the adhesion** between the ceramic and the metal alloy
- **Optimizes the application** of the wash opaque and opaque layer

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3rd STAGE: CERAMIC LAYERING

The ceramics used in dental technology are divided into two main categories:

1. **Feldspathic ceramics** (feldspar-based mixtures)
2. **Synthetic ceramics**

Synthetic ceramics do not present significant issues during the layering process; however, feldspathic ceramics require adherence to a specific protocol.

Layering Protocol for Feldspathic Ceramics
To ensure optimal adhesion between the metal alloy and feldspathic ceramic, the following guidelines should be followed when selecting and applying the ceramic:

✅ **Ensure a Thermal Expansion Coefficient (CET) compatible with the metal.** (CTE: 14,3 x 10^{-6} K^{-1})

❌ **Do not use Bonding**

💧 **Mix the opaque paste with a drop of distilled water** to dilute and improve its consistency, as well as to accelerate the drying process.

⚠️ ***Important:*** *This protocol is specifically designed for Mesa MAGNUM SOLARE discs (CTE: 14.3 × 10^{-6} K^{-1}). For the processing of other Mesa alloys, it is essential to follow the protocols provided by the manufacturer of the ceramic used.*

4th STAGE: COOLING

Working Parameters

- 450 C°: Opening the oven and gradual cooling

What is Cooling and What is Its Purpose?
After ceramic firing, the restoration must undergo slow and gradual cooling to room temperature to ensure the preservation of structural stability and the metal's properties

(hardness, strength, etc.), while also preventing defects. Gradual cooling allows for:

- **Avoiding internal stresses** within the alloy
- **Reducing the risk of ceramic fractures**
- **Stabilizing the mechanical properties** of the restoration

A rapid cooling process could lead to undesired movements of the alloy, potentially causing debonding or fractures in the ceramic layering.

CONCLUSIONS

Strictly following this protocol ensures **optimal results** in the processing of **Cobalt-Chromium Magnum Solare**, maintaining **dimensional precision, mechanical strength,** and **excellent ceramic-to-metal adhesion.**

Magnum Solare is a Medical Device manufactured by Mesa Italia S.r.l.

For any doubts or specific requests, always refer to this protocol, to the Instructions for Use (IFU) of the Medical Device, or directly contact the qualified personnel of Mesa Italia S.r.l.

APPENDIX – MAGNUM SOLARE: TECHNICAL DATA

Chemical Composition (Percentage)

Cobalt (Co)	66
Chromium (Cr)	27
Molybdenum (Mo)	6
Other (Si, Mn)	<1

Physical and Mechanical Properties

Solidus-liquidus temperature	1307 ÷ 1417 °C
Thermal expansion coefficient	(25 ÷ 500 °C) 14,3 x 10^{-6} K^{-1} (25 ÷ 600 °C) 14,5 x 10^{-6} K^{-1}
Melting point	1470 °C
Density	8,4 g/cmc
Vickers hardness	255 HV10
Percentage elongation at fracture	11 %
Yield load strength	(Rp0.2) 395 MPa
Modulus of elasticity	233 GPa
Maximum firing temperature	980°C
Colour	White

Mesa Italia S.r.l. complies with the latest Quality Standards and adheres to the strictest international criteria for the manufacturing of Class IIa and IIb Medical Devices. The company continuously updates its Management System in accordance with the Standards UNI CEI EN ISO 13485, UNI EN ISO 9001, MDSAP (Medical Device Single Audit Program).